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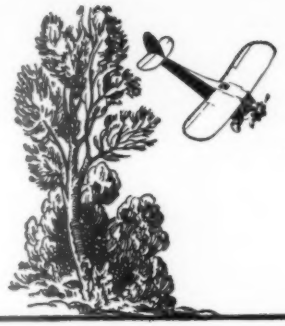

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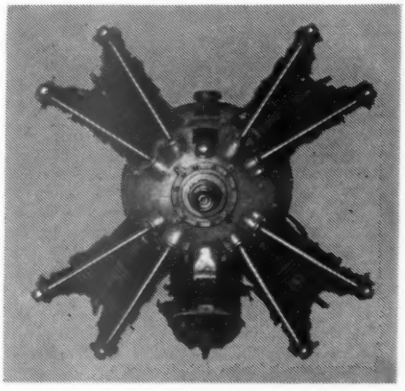

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May 26, 1928.

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Your claim of 40% increase in climb as a result of half-speed propeller efficiency seems absolutely justified.

Through the kindness of Leslie Cooper and "Dan" Beard at Curtiss Field, I recently had the opportunity of flying a stock "Cam" Engine Travel Air 'plane for an hour and a quarter, every minute of which I enjoyed thoroughly. With proper installation your Caminez engine surely gives a smooth, constant flow of power with as little vibration as any engine I have ever flown.

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The Robertson School of Aviation is one of the oldest and largest in this country, and is probably the best known. It is going into its tenth year with over 500 graduates. Courses are thorough. They are complete—flying, ground work, lectures, text book study.

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The combination of all these advantages is something that no other school can offer you. Consider them seriously. They are important.

The demand for well trained pilots is growing by leaps and bounds. Get in on the ground floor of this great, new, thrilling industry by getting the right kind of training *now*, from regular Air Mail Pilots. They teach you so well that we require no bond and make no charge for breakage.

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POPULAR AVIATION

Published Monthly

A magazine for everyone interested in aviation progress and development

Vol. 3 AUGUST, 1928 No. 2

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The Game for Daring Young Men

GET away from the dull, prosaic grind of humdrum work—the narrow restrictions of petty, uninteresting jobs! Break into one of the most fascinating, most thrilling occupations since time began—Aviation—the virile, exciting, romantic game for men of sporting blood.

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What other occupation offers you more amazing opportunities? Thrills such as you never had before—the praise and plaudits of the multitude—and a chance to get in on the ground floor where rewards may be unlimited.

Aviation is growing so swiftly that one can hardly keep track of all the astonishing new developments. The skies are dotted with daring young men—from every country come stories of new feats—new victories—new heroes! Everything is set for one of the greatest booms in history. Big fortunes came out of the automobile industry and out of motion pictures. Big fortunes will also come out of Aviation! The development of Aviation as an industry is bringing with it a call for trained men. Those who qualify quickly should find themselves on the road of undreamed of money—success—popularity—and prominence!

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Via Air

WHEN a shipping clerk tosses a new stencil to his assistant and says casually, "Mark that one for the Air!" . . .

When the General Sales Manager frenziedly phones the routing clerk and asks how he can get samples to Milwaukee by the next afternoon, and the routing clerk says calmly, "That's all right, sir, we'll put them in the Air!" . . .

When the Chief Engineer turns apoplectic at a telegram from Dallas saying the power plant must shut down until a small part can be sent from the factory, and his secretary promptly suggests, "Why don't we send one tonight by Air Mail?" . . .

Then you will know that Aviation is an accepted tool of industry. *But that time has already come! For these humble portents are everyday occurrences in the routine of successful business.*

Since speed is the determining factor in competition for nation-wide markets, all great industries, all great commercial houses, are looking to the airplane for swifter transport of men, material and mail.

The skyways are well defined routes in active and continuous use. Only the fact that airports are stationed well beyond the boundaries of most cities keeps the average business man from actually seeing what is being done with commercial planes.

On the line that operates between New York-Chicago-Dallas there is a plane speeding on its way with important commercial loads every hour of the year. The Air Mail is giving service to a trade area of 62,500,000 people every 24 hours. Over a period of three years, flying regularly from Detroit to Chicago, Cleveland and Buffalo, Ford planes have maintained an operating efficiency of 95 per cent—a record not exceeded by the railroads.

Figured on a time basis, the transcontinental airlines have already reduced the railroad map of the United States to the dimensions of a region the size of Texas!

How can this fact be applied practically in business?

A Milwaukee manufacturer recently sold a cargo of locks in the New York market. By shipping *via air*, a thousand miles away, he put his locks down in New York as fast as his competitors could have delivered them from New England. . . . Shippers of oil from California to the Atlantic Coast save thousands of dollars in interest by forwarding Bills of Lading *via air*. . . . In March, last, a consignment of flowers was flown to New York, so they might arrive with the bloom of California fresh upon them. . . . Bankers are regularly saving anywhere between $125 and $5000 monthly on distant exchanges by sending their documents *via air*. . . . And the weight of freight and mail carried over the airlines of America already *totals millions of pounds.*

The time has passed for whimsical speculation! The time has passed for the meaningless thrills of spectacular flying! The tireless wings of commercial planes are as definitely at your service as the wheels of commercial trucks. *For more than a million miles the Ford all-metal, tri-motored planes have already flown, carrying freight, mail and passengers!*

Advertisement of the Ford Motor Company, appearing in the *Saturday Evening Post*—the first of a series of messages on air transportation that Popular Aviation will reprint each month.

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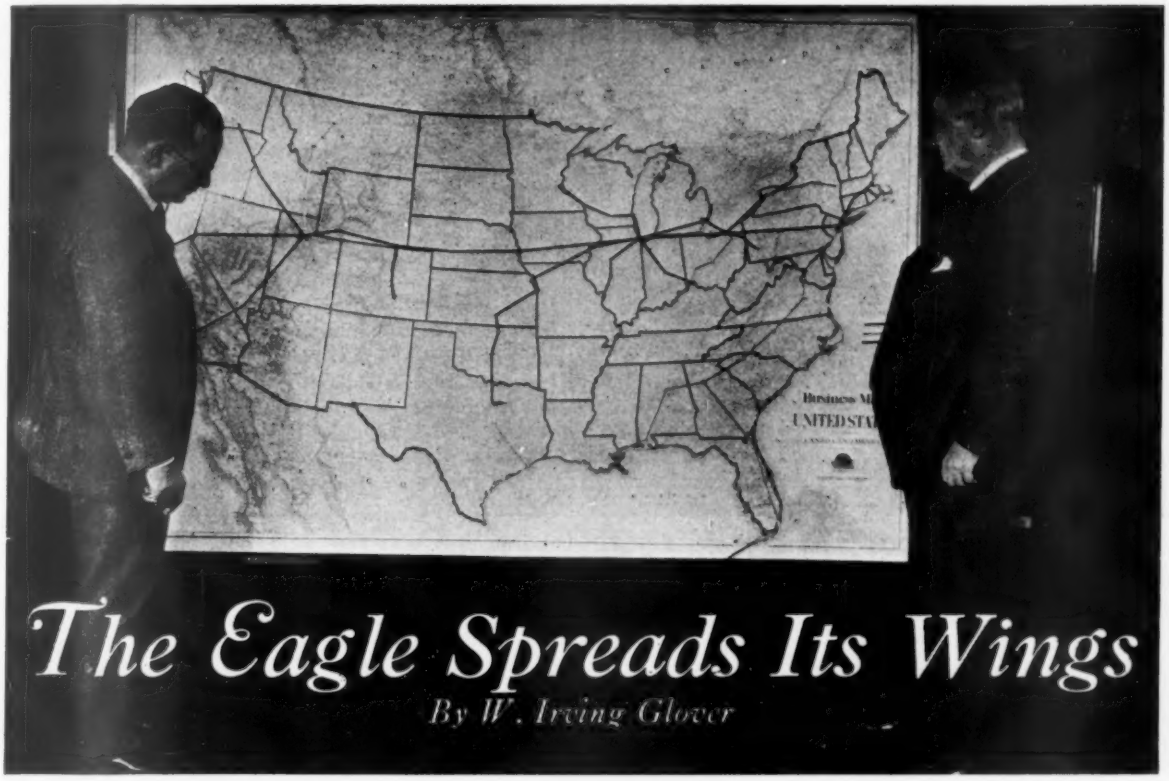


The Eagle Spreads Its Wings

By W. Irving Glover

Postmaster General New and Assistant Postmaster General Glover studying the air mail routes of the country.

Mr. Glover is the Assistant Postmaster General in Charge of Air Mail, and this article commemorates the tenth anniversary of the establishment of the Air Mail.

THE tenth anniversary of that first 218-mile flight between New York and Washington which inaugurated our national air mail service was recently celebrated by the Postoffice Department. Coinciding with this birthday is the completion of an important new link in the great transcontinental network of air mail routes—from Albany to Cleveland—and the lighting of the airway from Ogden, Utah, to San Francisco, California. Still more interesting as a coincidence is the recent opening of a steady air mail service from New York, southward through Washington, tying the North and the East to Richmond, Greensboro, Spartanburg, and Atlanta.

Such a record is a long hop from the balloon mail of beleaguered Paris in 1870, cast adrift to the mercy of the prevailing zephyrs, though in 1810 Sir Thomas Walker foretold the use of aircraft for mail, commerce, and the rescue of mariners and exploration—in all of which the airplane and the airship have now been turned to good account. Perhaps one may be permitted a just pride in the performance of our own world's first long-distance continuous air mail service as we pass its tenth anniversary.

At noon on a summer day in 1918, three pilots stood at their planes in New York, Philadelphia, and Washington, ready for the first air mail flight. All three were lieutenants in the Army Air Corps, loaned for purposes of experiment to the Postoffice Department, and they carried mail sacks weighing about four pounds. Today 3,000,000 pounds of mail are carried yearly through the air over millions of miles; a single sack now may go over lighted routes by floodlighted landing stations, the entire 2,600 miles from New York to San Francisco.

When those first three pilots stood by their planes on that day in 1918 the time when this country would be netted across by great aerial mail routes, operating regularly on schedule, seemed to many a far-off dream. It was travel in a new dimension. If it was to be developed, it must be developed first by those who had the nerve to fly and then by those who had the nerve to back it financially. Yet the dream of ten years ago already has become only the starting point of a great vision for the future. Reaching out from our own country, we are already clasping hands through the air with our fellow peoples of the Western Hemisphere.

Working with the State Department and with the Postmaster General of Mexico, we are now completing plans for an international air mail service as significant to the story of international relations as it is to the story of transportation. From New Orleans, by way of Tampico and Vera Cruz, American planes will complete a run which will make it possible to send a letter by air all the way from Boston to Mexico City. Nor will the story end there. From New Orleans to Houston, by a projected three-way connection—to Brownsville, to Laredo and to San Antonio—it will be possible to connect with any route by which the Mexican service may enter the

The first of the twenty Douglas planes for the Post Office Department being received by Postmaster General New, and Asst. Postmaster General Glover.

United States in the future; either through the Brownsville or Laredo gateway.

Next, we vision the hook-up of the so-called "Pan-American countries." The department plans to establish air mail lines to South America that will serve the Central American countries and create an air mail service extending from Boston and Seattle to Concepcion. And it is actually in process of negotiating agreements to pave the way for these lines, with good reason to hope for the fulfillment of its dreams. From Havana, which already connects with us by air to Key West, the projected line would run southward and westward to Mexico, Guatemala, Honduras, Salvador and Costa Rica; thence into the Canal Zone, and from there drop southward along the western coast of South America through Colombia to Ecuador and Peru, reaching all the way down through to Chile, even south of the Chilean capital, as far as Concepcion. Incidentally, the 150-mile hop from Key West to Havana will constitute the longest over-water span made by the postal air service.

Concepcion is chosen as the southern terminus of this hook-up because it is opposite a low pass in the Andes where an easy connection can be made with Buenos Aires. And, from the latter city a French air service is already operating northward and eastward toward Europe. About to be linked with the countries to the south, we are just now binding ourselves by air closer to Canada, by the route opened June 25, between Montreal and Albany. And, on the purely domestic side, it is safe to say that the American air mail service is surpassed by that of no other country.

But let us go to the beginning of this great network, and consider the first proposals of air mail service that are now recorded in postoffice history. 'Way back in 1843 John Wise announced his proposal for a trans-Atlantic air mail service and Congress was petitioned without success for appropriation. Thaddeus S. C. Lowe followed with another proposal in 1859 and actually built his balloon; the largest ever constructed. Both ventures had the encouragement of the Smithsonian Institution, but neither was launched. Then came Donaldson, with whom Wise joined for a short period, and the monster Daily Graphic balloon of 1873 was launched on its unsuccessful cross-ocean trip. And, in 1902 there was the German airship inventor who offered to carry the mails from New York to Southampton within 50 hours by airship. No one had flown an airplane at this date and Santos Dumont had just accomplished the feat of steering his baby airship around a given point and back.

Then, in 1911, the first United States air mail route was established between Nassau Boulevard, L. I., flying field, and the Mineola postoffice. For the flying meet Postmaster General Frank N. Hitchcock established an official postoffice on the grounds, with twenty collection boxes. For a period of nine days Earle Ovington's Queen monoplane carried the mail by air at regular intervals, dropping the bags at Mineola for the postmaster there to pick up. Hitchcock himself, with a sack of mail, was a passenger in a demonstration flight with Captain Paul W. Beck, U. S. A.

Senator Sheppard had urged air mail in 1908-1909 and now, in 1912, the Postoffice Department realized the possibilities and asked for $50,000 for the inauguration of an air

Loading a plane on the transcontinental route.

mail service, but the item was knocked out in committee. However, in 1916, the Postoffice Department was authorized to ask for bids for carrying the mails by airplane between New Bedford, Conn., and Nantucket, Mass., and over certain routes in Alaska. Strangely enough, no one bid on the easy New England route and Earl L. Byers was the sole bidder on the Seward-Idotard route of the proposed Alaskan system, but his bid was not accepted.

And right here is the place to answer the question, "Why did the Postoffice Department relinquish to private control the operation of the system of airways for the transportation of mail by air—why not operate the air mail as a government institution?" The question might be covered in general terms by the statement that it is not, and should not, be the policy of the government to conduct a business that is essentially one for private initiative. A more specific reason is that the government is deeply interested in the development of the science of aviation, both from military and commercial standpoints, and believes that the more Americans permitted to become interested in the business, the greater will be its ultimate development.

The government is handicapped more or less by necessary red tape from pursuing progressive steps where private endeavor, without such shackles, may proceed with only such limitations as are imposed by capital and business sense. For instance,

The new five cent air mail stamps bear a photograph of this, the world's highest beacon on Sherman Hill in the Rockies.

the government can not transport passengers nor carry merchandise by air, both of which are necessary to the successful operation, from a monetary standpoint, of commercial aviation. The mails are carried on the railroads, but the government does not operate the railroads. The same is true of steamships used in the transportation of mails to and from foreign countries. Whereas among European countries it is commonly the case to provide subventions or government subsidies, the United States Postoffice Department never, from the beginning, had any such purpose in mind.

While European governments subsidize seats, mail and express, we deal with the commercial air mail companies in the matter of carrying mail as we deal with other transportion companies—with this difference, that the law requires all railroad companies engaged in interstate commerce to carry mail on request. That provision of the law does not apply to air mail companies.

It was to accelerate the development of commercial flying in America and to aid in keeping this country abreast of the heavily syndicated air lines projected abroad that the department inaugurated its air mail service. But a more far-reaching reason, perhaps, was the thought of creating an air reserve as a supplement for the military air services for use in the event of war. Costly mistakes have been saved private initiative through the experience gained and made available to those who are to take part in the development of commercial flying on the basis of regular schedules.

As proof that the air mail service has been of value, let me recall that in 1923 the Postoffice Department was awarded the Collier trophy for having operated a service on regular schedules under all sorts of weather conditions for that year without the loss of a single life. The following year the trophy again came to the department for having given night flying to the world, also operated on regular schedules and in disregard of ordinary adverse weather conditions. This was made possible through the development of a lighted airway which, at first, was laid down on the transcontinental route between Chicago, Illinois, and Cheyenne, Wyoming. Only last year Shirley J. Short, one of our pilots, was awarded the Harmon trophy for flying 2,000 hours without an accident, and without once veering from schedule.

Moreover, the lines are demonstrating the value of our idea as an undertaking for private enterprise. They are beginning to pay. Our first great experiment is becoming a demonstration in America's belief in sound business principles. During those laboratory years and during the performance of services highly valuable to the government and to the

W. Irving Glover holding the mail bag which Commander Byrd carried from New York to Paris.

Pilot Shirley J. Short and the Harmon trophy presented to him last year for flying 2,000 hours on schedule and without accident.

future of American aviation, less than $16,250,000 of Uncle Sam's money was expended by the Postoffice Department. Of this close to $2,250,000 was handed back for excess air postage on the transcontinental route during the two and one-half years from July, 1924, to February, 1927, alone. And, at the end of that time the Postoffice Department auctioned off twenty-six planes at an average price of around $7,000 apiece, gave some planes to the forest patrol for the work of fire prevention, fifteen to the War Department and some to the Department of Commerce for use in connection with the establishment and maintenance of lighted airways. After all deductions are made, all we have paid for the greatest step in aviation history is $9,500,000.

Practical as it is, the air mail has already given the country a record of performance equaled only by its record of devotion. I have said that achievement was possible mainly through the nerve of the pilots and the nerve of the backers. And our pilots have shown in full measure they are the stuff from which heroes are made. "Bring the Mail Through!" That slogan of the Postoffice in all its departments has inspired them, whether, like Lindbergh, they carried mail for private contractors or whether they date back to the days of government operation.

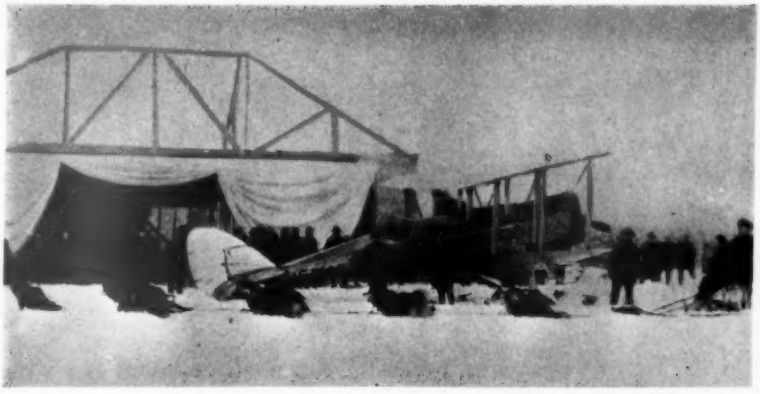
These ten years, since our first air mail flight, have been spectacular in their demonstration of the practical. The records of the air mail pilots glisten with stories of their abilities as flyers as well as of their personal heroism and their unfailing sense of humor. It is invidious to choose among them, perhaps. Yet a few illustrations, taken almost at random from the records, will give some idea of how they have brought the mail through.

Consider the case of Pilot R. E. Ellis. He left Rock Springs, Wyoming, with the regular westbound mail, bucking a strong head wind, circled the field, attaining an altitude of 9,200 feet (about 200 feet above the mountains) and headed for Salt Lake. While attempting to cross the mountain just west of Rock Springs field the ship was caught in a down draft which, despite the fact that the motor was wide open, forced it down into the side of the mountain, striking about 500 feet below the peak. After hitting the ground the plane slid back about 50 feet and stopped at an angle of about 80 degrees, the side of the mountain being almost perpendicular. To reach the ship the mechanics that later had to climb to the top of the snow-line—about 100 feet above the plane—formed a human chain, and it took them two hours to reach the plane. But Ellis didn't wait that long to deliver his precious cargo. He rolled his mail pouches down the ledge and got them through.

Snow storms are about the worst of the Rocky Mountain menaces. For five years aviators flying from the far western route have carried snow shoes as part of their regular equipment, and many of the planes are fitted with "snow shoes" instead of wheels. Pilot Eugene Johnson was the first to put them to use. Johnson crashed on Tamarack Flat, wrecking his plane but escaping unhurt. His report to the department tells what happened next.

"I had lost my sense of direction in the crash, so with the aid of a pocket compass I headed south. The snow was 10 to 15 feet deep, and I was told later that 40 inches of it had fallen in the preceding 24 hours. My snowshoes sank into it for at least a foot at every step. This, added to the fact that there was a 45 to 50 degree slope, covered with crevasses, made the going pretty bad. It was for this reason that it took me so long to get word to Reno. After four hours of climbing I picked up the railroad and started hiking west—down grade. Found a telephone in

Postmaster General Harry S. New, Colonel Charles Lindbergh, Assistant Postmaster General W. Irving Glover, and Colonel Wm. B. Robertson.



Alaska's first air mail—Fairbanks to McGrath. The pilot is Ben Eielson, who made the polar trip with Elkins.

a snow shed about a mile away and got assistance for the mails."

Then there was Henry Boonstra. Forced down upon a rocky ledge 9,400 feet high, somewhere between Salt Lake City and Rock Springs, he crawled for thirty-six hours on his hands and knees through snow to an abandoned ranch house. Thence he got to a telephone. When he finally got back, got the mail and brought it to Colesville, Utah, the whole town turned out with a band to celebrate his arrival.

Paul Scott, out in Nevada, took the mail into a hole in the fog in Saddle Pass. The fog closed down. He banked, turned to come out with a visibility of twenty feet, leveled, and started climbing—when he found he was scraping the tops of the trees. Crashed at 8,200 feet on the edge of the pass, he found his left shoulder out of joint and his left arm beginning to freeze. He noticed he had a cigarette. Then he noticed he had left his gun. Then he noticed the heavy fog, giving no sun for bearings. Then he noticed he was lucky to be able to notice anything! Struggling through the snow, he slipped on a rocky ledge and slid and tumbled 1,000 feet—it put his shoulder back into joint and restored the circulation. He got through to the railroad.

Wesley Smith found flames bursting through the motor wall at his feet. Though the fire burned through the motor cowling and singed his face and clothing he was calm enough to send his companion into the cabin to pile all the mail as far back as possible. Then he managed to "bring the mail through" by a clever landing in a corn field.

Before the completely mapped air routes, the lighted airways of today, R. B. Levisse owed his life to his memory for air landmarks. Running out of gas, oil, and water, twenty miles east of Placerville, he remembered a certain pear-shaped clearing he had observed on previous flights. From 8,000 feet up he made a "dead-stick" landing—and brought the mail through.

When the department asks its pilots for a report of their experiences it is frequently hard to get anything. It is all in the day's work for them. Often a situation which would make a story writer's reputation as a thriller is turned off in a jest. For pure unadulterated American humor, take the classic of Dean Smith:

"Dead-sticked—flying low—only place available—on cow—killed cow—wrecked plane—scared me—Smith."

That the boys are successful in sticking to their slogan is shown by the fact that in over 20,000,000 miles flown with mail in which more than 9,000,000 pounds have been carried, but 2,386 pounds have been lost. On July 1, 1928, there were twenty-two routes in operation with a total mileage of 10,058, with 60 station stops. Every day mail pilots fly a distance of 22,448 miles, carrying mail averaging nearly 5,700 pounds. Five other routes, under contract, also extensions of routes already operating, are expected to begin operation during the year, adding 2,789 miles to the system, and making a total of 12,847 miles. Two other routes, with a mileage of 1,383, have been advertised and contracts will probably be awarded during the year. Already 7,571 miles of these airways are lighted, and supplied with weather information.

Among the treasures of the Post-office Department is Lindbergh's account of his third and latest parachute jump—made on the night of November 3, 1926, as the flyer was battling rain and snow over Covell, Illinois, on his northbound trip from St. Louis to Chicago—the jump that earned him the name of "Lucky" Lindy. Flying blind in an endeavor to elude the elements and find a clearer path, his gasoline supply became so low as to preclude a return to Springfield, his last previous stopping point. He could not see land—not even the lights of towns along the way. Parachute flares failed to give him any information as to his position. But read Lindbergh's own story:

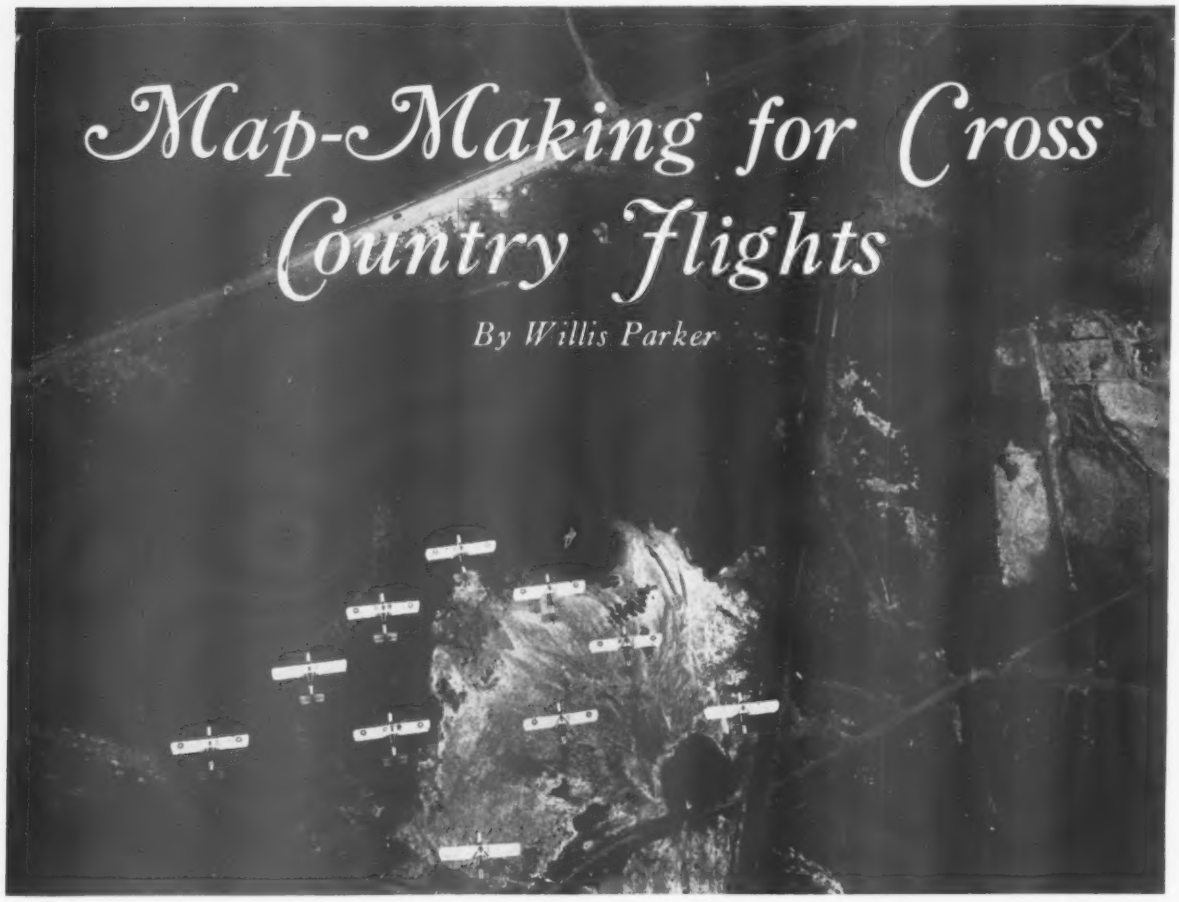
"When about ten minutes' gas remained in the pressure tank and still I could not see the faintest outline of any object on the ground I decided to leave the ship rather than attempt to land blindly. I turned back southwest toward less populated country and started

(*Continued on page 92*)

Pilot Henry G. Boonstra, lost four days when forced down in a blizzard.

Map-Making for Cross Country Flights

By Willis Parker



Here is a practical article on cross country navigation showing in concise form a simple method of laying a map course.

TO the average person the preparation of maps and data for a cross country airplane flight either seems to be a highly complicated proposition or else no job at all—merely the purchasing of an automobile road map showing the cities and towns, the rivers and railroads in the region over which one expects to fly.

It is neither complicated nor is it a sinecure. Witness the preparations made by Robert Rhea, a Colorado Springs man, who, though an invalid, recently flew more than 3,900 miles in an open cockpit, Alexander Eaglerock plane. At the stick was Captain Zimmerman, an experienced pilot, but Rhea was the navigator.

While Zimmerman checked the plane and engine for the flight, Rhea, propped up in bed and supplied with a number of state maps, figured out the route to be followed. Rhea's system seems easy; he says it's easy and that a child should be able to work it out. For the benefit of the hundreds of "navigators" who will be taking long distance flights within the next few years, we'll let Rhea explain his system:

"The method of preparing navigation plans which I used was to first take the map of the United States and draw a direct line; for instance, from Colorado Springs to El Paso, Tex.," he said. "Then by carefully examining Rand-McNally state maps, to see where the main trunk line railroads and principal highways ran with reference to direct air line, I sketched in, on the large map, these railroads and highways, and where I found the air line diverging too far I would bend it around from town to town, so that by flying the reconstructed route I would at no time be further than two miles gliding angle, in case of a dead engine, from a railroad or a main highway. I knew that it was necessary, on account of the condition of my health, to eliminate any possibility of having to take a long walk in case of trouble.

"After determining from my large map the town-to-town route to be followed, I then took state maps and ruled heavy lines from one town to another over which we proposed to fly.

"Then the next stage was to take a pair of dividers and step off every ten miles of the route, for instance, Colorado Springs to El Paso, drawing short lines across the ten mile points which I called stations. Thus the first ten miles from home became Station No. 1; twenty miles, Station No. 2, etc. Then beginning at the El Paso end and using a different colored pencil, I called El Paso the 'Zero Station,' ten miles north of it was Station No. 1, etc. In this way, with my map in my lap, fastened to the map board, I would see, for example, when passing over Alamogordo, N. M., that I was 46 stations,

or 460 miles, from home, and that I had 8 stations, or 80 miles, yet to go before reaching El Paso.

"This method makes for quick mental calculation, which is necessary when flying a plane, watching instruments and otherwise properly attending to the business of going somewhere in an airplane.

"Then, starting in with Zero Station at Colorado Springs, I put in, with another colored pencil, opposite this station on the map, 'Zero Hour,' as being the starting time. I tied an Ingersoll watch to the cabane strut, where both the pilot and myself could see it, and this would be set back to 12 o'clock at the instant the flight was started. I assumed an average flying speed of 75 miles an hour, which means that every ten miles would take exactly 8 minutes. Beside Station No. 1 I wrote '8 minutes,' beside Station No. 2 '16 minutes,' etc. Now, when flying the route and Raton, N. M., is seen just ahead, a glance at the map would show that 140 miles had been traveled and the figures on the time schedule would show that we should have been in the air one hour and 52 minutes since hopping off. A glance at the watch will show how much the schedule has been missed. For instance, one hour and 52 minutes is 112 minutes. If this distance has been covered in 100 minutes, then a quick mental calculation tells you that you have approximately exceeded the schedule by ten per cent and conversely if flying schedule is 75 miles an hour and it has been exceeded ten per cent you are averaging 82 miles an hour, and on the assumption that the same rate will be maintained to El Paso, by subtracting 10 per cent from the theoretical time due in El Paso you will be able to pretty nearly name the minute that you will set down there.

"It was amazing how accurately these figures worked out. Time after time we were able to forecast within five minutes our time of arrival at points many hundreds of miles distant.

"Now comes the matter of planning the compass readings. All maps are laid out on true north projection. Magnetic north is not the true north and the magnetic north reading varies in every location, consequently it was necessary for me to determine from Department of Commerce bulletins what this variation was at all possible points. For instance, in Colorado Springs the variation is 14 degrees east. In order to tell the compass course to take out of Colorado Springs it was necessary to take the state map, lay a protractor on it and measure the flight line in terms of true north. Then to subtract 14 degrees from this reading to reduce it to compass reading. This figure was then written in in large figures to show the reading for this leg of the course.

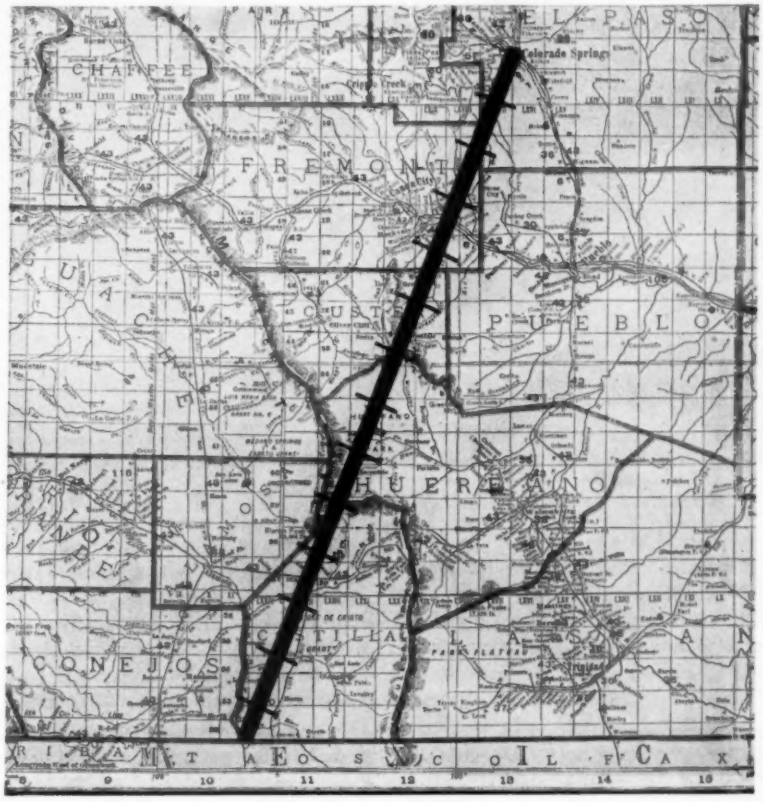
"Every time the line changed its direction on the map it was necessary to compute the compass reading to be followed over that leg of the journey.

"The next item in map preparation was to determine as far as possible the elevation above sea level at frequent intervals, so that by comparing the elevation with altimeter readings in the plane it would be possible to know accurately how far above the ground we were flying. Then it was necessary to procure data on all emergency landing fields on the course to be flown and spot them on the map with a symbol, such as '2-m. N. E.,' which means that the landing field is two miles northeast of the center of town.

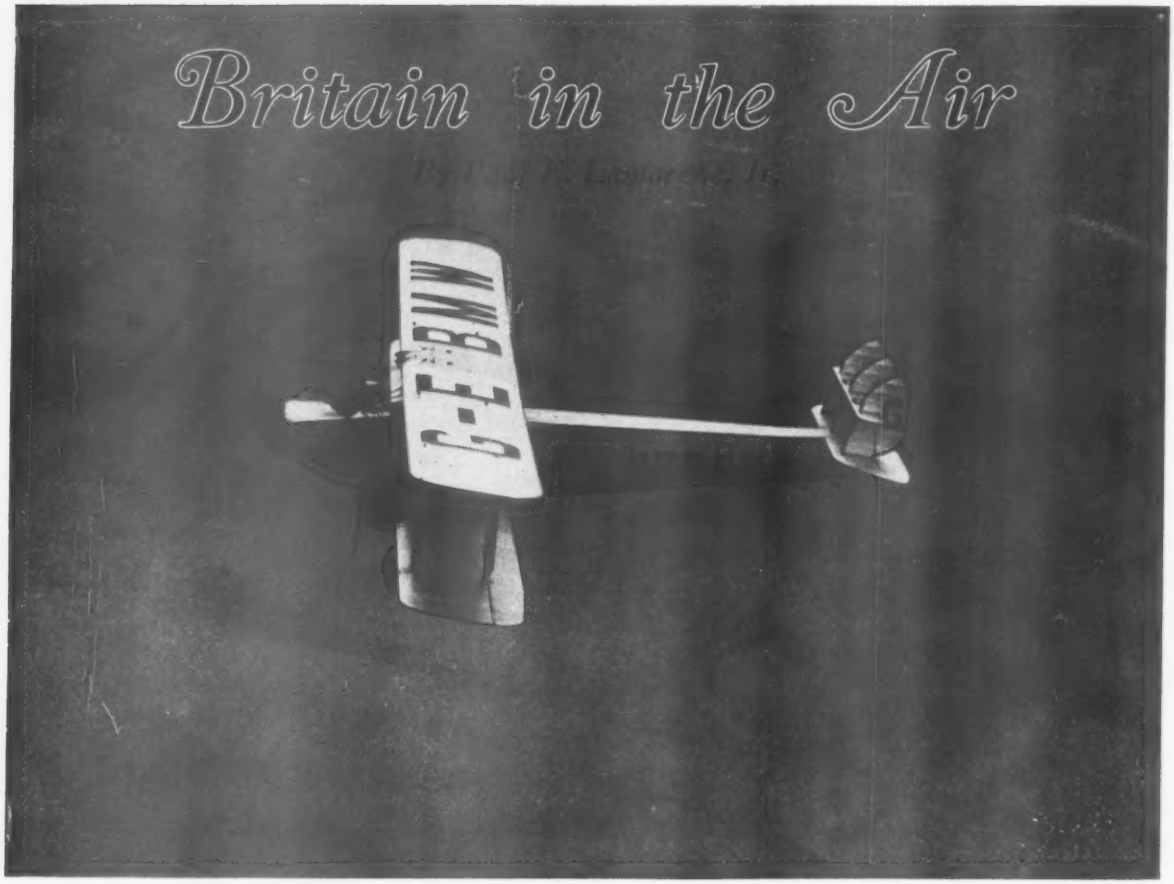
"It all sounds complicated, but actually any child can prepare such a map, and it is an interesting pastime to do it, and careful preparation of the map in advance is certainly time well spent.

On account of storms shortly after Mr. Rhea and Captain Zimmerman started out, it was necessary for them to climb to 11,000 feet and fly by instruments. Raton Pass was 10,000 feet and if it had not been for the well prepared maps it is likely that they would not have dared to continue their flight lest they crash into the face of the mountain in their effort to cross over it.

Much of the data was collected by Mr. Rhea from the United States Department of Commerce. Compass variations and landing field information may be obtained from Government bulletins, while elevation data can be taken from the better grade of large state maps.



Map (courtesy of Rand-McNally) showing method of laying out course. Mr. Rhea's course was laid in a slightly different direction.



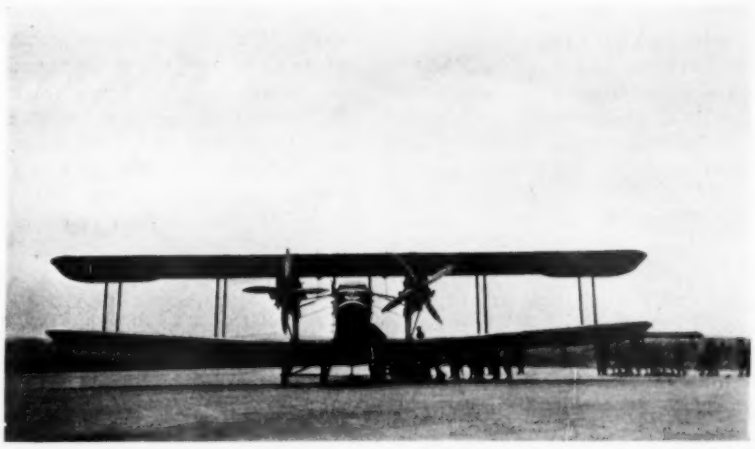
A fourteen passenger De Haviland 66 Hercules plane on the Middle East services of Imperial Airways.

PERHAPS the best known commercial air line to American travellers in Europe is that of the Imperial Airways, Ltd., whose big silver wing planes annually carry thousands of tourists across the Channel over the London-Paris route. It has been the pleasure of many Americans to view the ever changing scenery that spreads itself beneath them as they are quickly transported between these two large European cities. Looking down on England and France from the air gives the traveller an impression of the two countries that would be impossible to get from a railroad coach. As the plane roars its way from London to Paris, such towns as Sevenoaks, Kent, Penhurst, Tonbridge, Ashford and Lympne in England pass underneath and when the plane passes over the Romney Marshes and heads out over the Channel towards the French coast a new and different world seems to unfold itself below. Boulogne-sur-mer spreads out at the water's edge and then such towns as Etaples, Abbéville, Amiens, Beauvais and Beaumont appear in succession until the Paris airport, le Bourget, is reached after two hours and a half of flying. Doubtless many who have travelled on these planes have been greatly impressed by the efficiency and manner of operation and have wondered how it has all come about and what experiences have been met in the development of this big system of aerial transportation. Perhaps many are surprised when they learn that the company which operates these London-Paris planes also operates passenger lines as far away as Bagdad and Basra in their efforts to reach out to the very corners of Britain's far flung empire. The Imperial Airways represent Britain's biggest effort in commercial aviation and is the principal civil aviation company of the empire. It is an organization that compares with the best in Europe and their big silver winged biplanes are a familiar sight on many Continental air fields, as they maintain their daily schedules in bringing London closer to distant European capitals.

As with other European countries who have developed commercial air fleets, the development of civil flying in Britain has taken place since the war. It was in August, 1919, that the first commercial plane for passengers left the field at Hounslow, near London, on a flight to Paris which was to be the forerunner of a daily service that now operates with the regularity of a railroad system. This first effort was not accomplished in a big twin motor Handley-Page biplane with its comfortable seats and modern equipment, but in a small converted De Haviland war plane whose small cabin was barely large enough for its

two passengers. Flying to Paris in those days had its many uncertainties and the unexpected could always be depended upon to happen. It was not very unusual for the one motor that roared but a few feet forward from the tiny cabin where sat huddled the two courageous passengers, to falter and make a forced landing necessary. The comforts offered to the passengers were hardly anything to boast about. The noise of the motor made speech impossible and there was no space in which to move in the cabin. There was no modern radio or other safety devices and the customer who would fly from London to Paris in those early days of commercial flying had to be somewhat of an optimist. Mail often constituted the only cargo that the planes carried, for customers were often few and far apart. Yet those early flights proved conclusively that the public were interested in flying and were willing to avail themselves of a passenger service in order to reach their destination quickly. As long as there was a demand for such service the prospects of expansion appeared bright. There were remarkably few accidents and people began to have faith in flying as a means of transportation.

The original London-Paris service was operated by the Aircraft Transport and Travel, Ltd., whose parent organization was the Aircraft Manufacturing Company. Shortly after the inception of this service the Handley-Page Transport, Ltd., inaugurated an air line to Brussels and a second line to Paris, using converted Handley-Page bombing planes, which were the forerunners of the planes now used in the British services between London and the Continent. The Brussels service, however, was shortly afterwards discontinued, since there was not enough demand for its continuance, and it was later resumed as commercial flying in Europe developed, in conjunction with foreign lines operating on this route. The British lines found plenty of competition on all of their routes. On the London-Paris route there were several French lines competing with themselves as well as with the British lines, the principal of which was the *Compagnie des Messageries Aériennes*, now known as the Air Union. What is now known as the *SABENA* line (*Société Anonyme Belge D'Exploitation de la Navigation Aérienne*) furnished competition between London and Brussels and the Dutch K. L. M. line (*Koninklijke Luchtvaart Maatschappij*) operated a service between London and Amsterdam with their Fokkers in conjunction with the Handley-Page Company over the same route. German planes likewise inaugurated service which made use of the London airport. Yet, despite the competition that seemed to come from all sides, the British lines in 1920, their first full year of operation, carried 6,383 passengers, as compared with 1,770 passengers carried by French planes during the same year.



The City of Pretoria, a Handley-Page W-10, used by the Imperial Airways between London-Paris-Basle and Zurich.

In 1921 the London-Paris lines received a severe setback resulting from their competition with the French service between these two cities. The fare of twenty guineas had been reduced to fifteen and later to ten, and for a long time this remained the price of the one way fare on all services. When the French services received a subsidy from their government they were able to reduce the price further, bringing it down to six guineas to make a strong bid for more customers. This then made it impossible for the British lines to compete with them, since they could not afford to carry passengers at

The City of Birmingham, an Armstrong - Whitworth Argosy tri-motored plane, carrying twenty passengers, pilot, navigator and cabin steward.

such a low price and for a period of nineteen days there was no service between London and Paris on any of the British lines. Finally the British Government established a subsidy scheme whereby Handley-Page, Ltd., and Messrs. Instone and Company, who had taken over the flying stock of the Aircraft Transport and Travel Co., were to fly on alternate days between London and Paris. This arrangement lasted until September of that year, when both lines continued to operate daily over this route.

In 1922 there were three British lines operating between London and the Continent. Messrs. Daimler operated a line between London and Amsterdam which connected with the German Aero Lloyd Company for Berlin; Messrs. Handley-Page, Ltd., on the London-Paris route; and Messrs. Instone and Company between London-Brussels and Cologne. In August, 1923, the Handley-Page Company extended its services from Paris to Basle and Zurich. The British Marine Air Navigation Company was also operating a flying boat service between Southampton and the Channel Islands. In March, 1924, these four companies merged and became known as the Imperial Airways, Ltd., with Sir Eric Geddes, G. C. B., B. G. E., as the Chairman, and Sir W. S. Brancker, K. C. B., A. F. C., as Director. They had when combined a capital of one million pounds ($5,000,000) and a subsidy of equal amount to be spread out over a period of ten years. With this and the combined equipment of the four companies they were able to operate as one big system of airlines under the same leadership and with the support of the Government. The merger made them one of the strongest commercial air companies in Europe.

The progress of the Imperial Airways, Ltd., since its establishment has been excellent. Since its inception until March 31, 1927, a period of three years, its planes have flown a distance of 2,502,626 miles, carrying 39,705 passengers and 1,835½ tons of freight, mails and baggage. From April, 1924, to May, 1926, British planes flew a distance of 1,830,465 miles over continental routes and carried 26,379 passengers and 1,596 tons of freight. More recent figures in their last Directors' Report show that this line has carried 52,000 passengers without accident injury or loss of life to anyone, between January 1, 1925, and November 15, 1927. Since the issuance of their last Report their activities have increased the totals to 63,000 passengers, while the mileage has reached the total of 3,110,000 miles. The total of 26,721 passengers carried during 1926 is in striking contrast with the modest total of 6,383 passengers carried in 1920. The planes of the Imperial Airways carry 52% of the total of passengers using cross-Channel air lines between London and the Continent.

A Bleriot 165 in the service of the French Air Union between Paris and London. Carries six passengers and is driven by two 450 h.p. Rhone-Gnome-Jupiter motors.

The planes of this line operate daily over 1,235 miles of air routes between London and Continental cities, while additional mileage was added to their air lines in 1927 in the extension of the service between Cairo and Karachi. This later service, however, has been somewhat handicapped by restrictions against foreign aircraft by the Persian Government, but British diplomacy has practically smoothed this situation over. During 1927 the British Government granted a subsidy of £95,000 ($475,000) for the development and maintenance of the air lines in the Middle East. At present the following lines are operated by the Imperial Airways:

London-Paris. (Three daily services in summer, two in winter).

London-Brussels-Cologne. (Connecting with the Deutsche Luft Hansa system. Daily service).

London-Le Touquet-Paris. (Special holiday services in summer.)

London-Ostend. (Daily from May until the end of August.)

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London-Amsterdam. (In conjunction with the Dutch K. L. M. line.)

Cairo-Gaza-Bagdad-Basra (extension to Karachi once a week).

In 1921 the flying field at Hounslow was given up in place of another field at Croydon since this location was considered as being out of the London fog area. The Croydon field is much larger and is now used by all commercial lines as the London airport. A large building program involving an expenditure of £250,000 ($1,250,000) has just been completed at this field and it is now one of the best equipped airports in Europe. While London's position is hardly central, as far as European air traffic is concerned, Croydon Field, nevertheless enjoys a large amount of international air traffic. During 1926, as an example, the total num-

ber of air travelers who either arrived at or departed from this field amounted to 26,500 and of these 17,000 were carried by the Imperial Airways.

It is the aim of the British Air Ministry to join all of the British possessions to London by the air line and eventually it will be possible to fly from London to Australia, a distance of 12,000 miles. The flight has already been accomplished several times and Sir Alan Cobham's flight to Australia more than a year ago has proven the practicability of such a plan. Hinkler's successful flight in a light plane last winter will in all probability hasten plans to eventually establish a continuous service of airlines over this route. Such lines as already exist in the Near East and Middle East are but links in this dream of England's future air development and before many years England will have joined these links together and forge what will probably be one of the longest continuous passenger lines in the world when completed.

Perhaps one of the most ambitious plans for joining the far corners of the British Empire with London will be effected with the inauguration of a dirigible service between London and Canada as well as between London and the important British possessions in the Near East. One of these dirigibles, the R-100, is now nearing completion in the Howenshire Hangars in Yorkshire at a cost equivalent to $1,750,000. It was originally intended that the first of two dirigibles planned would be ready for service this summer but due to labor troubles and other unavoidable delays, the R-100, the first to be built, will not be ready for trials until probably late in the autumn. Its first trips will probably be in the direction of the Near East and already mooring masts and facilities for refueling are being prepared at Karachi and other places. Much rivalry exists between the builders of the R-100 and the constructors of the new German dirigible LZ-127 which is being completed in order to compete with the British on a trans-Atlantic scheme. The British ship, will, when completed, have a length of 709 feet and a height of 130 feet while her displacement will represent 156 tons. Her six engines will give her a maximum speed of 81 miles an hour and her fuel capacity will give her a radius of 5,000 miles. It is not definitely known as yet, for what passenger routes she will be used, but it is probable that eventually she will cross the ocean to New York as regularly as an ocean liner.

The City of Ottawa, a Handley-Page W-10, about to leave Croydon Airport for Paris.

The flying stock now used by the British air lines is in striking contrast with that which was used at the outset but a scant nine years ago. The first De Havilland planes were, as has already been described, small converted war planes with a single motor and accommodations for two passengers. The Instone Company made use of two Vickers converted troop carriers for several years, but their type has since been superseded. This year, however, the demand for new flying stock has been so heavy that the British Government has decided to lend the Imperial Airways one of these huge Vickers troop carriers which when fitted out as a commercial passenger plane will carry twenty passengers and a useful load of baggage. The type which will be used on the London Paris line this season will be one of the new Vickers Vanguard twin motor biplanes. The first Handley-Page machines used between London and Paris were by no means like the big silver wing planes that nowadays carry thousands of Americans across the Channel.

The Prince George, a Handley-Page W-8, carrying 14 passengers, being unloaded at the Birsfelden Airport at Basle, Switzerland.

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London-Amsterdam. (In conjunction with the Dutch K. L. M. line.)

Cairo-Gaza-Bagdad-Basra (extension to Karachi once a week).

In 1921 the flying field at Hounslow was given up in place of another field at Croydon since this location was considered as being out of the London fog area. The Croydon field is much larger and is now used by all commercial lines as the London airport. A large building program involving an expenditure of £250,000 ($1,250,000) has just been completed at this field and it is now one of the best equipped airports in Europe. While London's position is hardly central, as far as European air traffic is concerned, Croydon Field, nevertheless enjoys a large amount of international air traffic. During 1926, as an example, the total num-

ber of air travelers who either arrived at or departed from this field amounted to 26,500 and of these 17,000 were carried by the Imperial Airways.

It is the aim of the British Air Ministry to join all of the British possessions to London by the air line and eventually it will be possible to fly from London to Australia, a distance of 12,000 miles. The flight has already been accomplished several times and Sir Alan Cobham's flight to Australia more than a year ago has proven the practicability of such a plan. Hinkler's successful flight in a light plane last winter will in all probability hasten plans to eventually establish a continuous service of airlines over this route. Such lines as already exist in the Near East and Middle East are but links in this dream of England's future air development and before many years England will have joined these links together and forge what will probably be one of the longest continuous passenger lines in the world when completed.

Perhaps one of the most ambitious plans for joining the far corners of the British Empire with London will be effected with the inauguration of a dirigible service between London and Canada as well as between London and the important British possessions in the Near East. One of these dirigibles, the R-100, is now nearing completion in the Howenshire Hangars in Yorkshire at a cost equivalent to $1,750,000. It was originally intended that the first of two dirigibles planned would be ready for service this summer but due to labor troubles and other unavoidable delays, the R-100, the first to be built, will not be ready for trials until probably late in the autumn. Its first trips will probably be in the direction of the Near East and already mooring masts and facilities for refueling are being prepared at Karachi and other places. Much rivalry exists between the builders of the R-100 and the constructors of the new German dirigible LZ-127 which is being completed in order to compete with the British on a trans-Atlantic scheme. The British ship, will, when completed, have a length of 709 feet and a height of 130 feet while her displacement will represent 156 tons. Her six engines will give her a maximum speed of 81 miles an hour and her fuel capacity will give her a radius of 5,000 miles. It is not definitely known as yet, for what passenger routes she will be used, but it is probable that eventually she will cross the ocean to New York as regularly as an ocean liner.

The City of Ottawa, a Handley-Page W-10, about to leave Croydon Airport for Paris.

The flying stock now used by the British air lines is in striking contrast with that which was used at the outset but a scant nine years ago. The first De Havilland planes were, as has already been described, small converted war planes with a single motor and accommodations for two passengers. The Instone Company made use of two Vickers converted troop carriers for several years, but their type has since been superseded. This year, however, the demand for new flying stock has been so heavy that the British Government has decided to lend the Imperial Airways one of these huge Vickers troop carriers which when fitted out as a commercial passenger plane will carry twenty passengers and a useful load of baggage. The type which will be used on the London Paris line this season will be one of the new Vickers Vanguard twin motor biplanes. The first Handley-Page machines used between London and Paris were by no means like the big silver wing planes that nowadays carry thousands of Americans across the Channel.

The Prince George, a Handley-Page W-8, carrying 14 passengers, being unloaded at the Birsfelden Airport at Basle, Switzerland.

This type of Handley-Page is being superseded by the type shown below.

The first Handley-Page planes were converted bombing planes capable of carrying six pasesngers and equipped, in some cases, with a single motor that was able to develop as much as seven hundred horsepower. Today none of the planes used on passenger services by the Imperial Airways, excepting small planes for charter, are equipped with less than two motors while some of the newer flying stock is equipped with three motors. The present fleet of the Imperial Airways is made up principally of Handley-Pages, Armstrong-Whitworths, De Havillands and Supermarine Flying Boats, while one or two Vulcans are used as freight carriers.

Handley-Page planes are perhaps best known to the American who likes to fly when in Europe and probably there are many who may have a friendly feeling for the City of Ottawa, the City of Pretoria, or the City of New York and others of the fleet of silver winged planes that have borne them safely over land and sea. These big planes with their dark blue fuselages and silver wings have borne the brunt of the Imperial Airways traffic and have proven themselves wonderfully dependable. They have been used on British air lines since the inauguration of commercial air services and have a remarkable record of service behind them. At present there are three types of Handley-Page planes in use, the W-8, W-9 and W-10.

The W-8 is the older type and similar in many respects to the W-10, of which it is a prototype. The W-9 is a three-engine plane and built to the same performances as the W-10. The W-10 represents the fruit of years of experience with these planes and is the latest type and equipped with all possible improvements in design and construction. The W-8, though slightly larger, carries fourteen passengers against sixteen carried by the W-10. All types are furnished with motors placed between the wings on either side of the fuselage. The specifications of the W-10 Handley Page are as follows:

Span	75 ft.
Length	59 ft. 4 in.
Total wing area	1,481 sq. ft.
Length of cabin	22 ft. 10 in.
Width	4 ft. 5 in.
Height	5 ft. 9 in.
Weight fully loaded	13,780 lb.
Maximum speed at 6,000 ft. altitude	106 M.P.H.
Landing speed	45 M.P.H.
Absolute ceiling	13,000 ft.
Landing run	200 yd.
Take off run	300 yd.

The Armstrong-Whitworth Argosy type planes are the largest planes used by the Imperial Airways. At present they are operating three of these, the City of Wellington, the City of Birmingham and the City of Glasgow. Each of these big planes carry twenty passengers, a pilot, a navigator and a steward who serves drinks from a compact little bar built into the after part of the cabin. It has been the writer's pleasure to enjoy a whiskey and soda while soaring through the clouds in one of these gigantic planes. The Armstrong-Whit-

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The City of Ottawa lands her passengers from London at the Le Bourget Airport, Paris. This is one of the new Handley-Page W-10 type, and has accommodations for 16 passengers.

"Stepping Out"

By Fa[illegible] Harmel

AN airplane was circling the flying field with the figure of a man in sitting posture suspended about 20 feet below it. The large crowd which had congregated on the field to witness an aerial demonstration, staged by the Missouri National Guard Air Service, assumed that this aerial merry-go-round was part of the entertainment planned for them, but other airmen on the ground sensed that something was wrong, particularly so when they perceived that ever so often the pilot waved his arm as if he was in distress.

The circling plane overhead was piloted by Major C. R. Wassall, and the man who was receiving the full benefit of the rushing breeze below it was Sergeant R. D. Douglas. The latter had planned a feat which he calculated would startle the spectators. It did, but not in the manner he had anticipated.

Sergeant Douglas had tied a rope around his waist and between his legs and the other end of it to the landing gear of the plane, the thrill planned being to walk out on the wing tip and jump off. Of course, he fell only the distance corresponding to the length of the rope, about 20 feet. He had knotted the rope at intervals to aid him in a hand over hand climb back into the cockpit of the plane. Unfortunately, however, he made the mistake of placing the knots too far apart, and he soon exhausted all his strength in his endeavor to make any progress.

At this particular time there was only a 20 minutes' supply of gasoline remaining in the tank of Major Wassall's plane and, realizing the unhappy plight of his passenger, he started circling the flying field and endeavored to attract the attention of the pilots on the ground. The rope was fastened to Sergeant Douglas in such manner that he could not have extricated himself when the plane landed, and he would have been dragged along to certain death.

Lieut. Fred C. Nelson, the Regular Army Instructor of the Missouri organization, who was present at the field, assumed that Douglas was seated in a trapeze and could leave at will. Accordingly, he secured a parachute and, with Lieut. Albert Smith as passenger, he took the air and had no difficulty in overhauling Major Wassall's plane. Lieut. Smith, standing on the wing tip as the planes were alongside, proffered the parachute to Douglas, but the latter shook his head vigorously and made signs to the effect that he wanted a knife with which to cut the rope. Lieut. Smith had no knife, and Lieut. Nelson, still unaware that Douglas was tied hard and fast, decided to put the wing of his plane abreast the Sergeant's body so that he could climb aboard. Naturally, Douglas could not take advantage of the situation, and as the plane came to him he pulled himself up and slid over the wing. In doing this it was seen that he was securely tied. The only remaining means of rescue was to pass Douglas a knife, in order that he might cut himself loose and drop into

a nearby lake. Lieut. Smith was landed in a field near the lake and made preparations to assist Douglas when he dropped into the water.

Lieut. Nelson quickly returned to the flying field and called for a volunteer to stand on the wing tip with half a dozen knives. Sergeant Jeddie Sharp responded, and when the planes were again alongside each other he not only placed a knife in Douglas' hand but closed his fingers over it to make certain that he would retain it. Douglas showed the knife to his pilot, who immediately glided over the lake into the wind as slowly as possible. Heading himself in the direction of flight, Douglas lay as horizontally as possible and when over the water about six feet cut the rope. He hit the water flat on his back, traveling head foremost, skipped once like a flat rock, sank, bobbed up to the surface and started swimming. Although he swam but a short distance, his strength was nearly spent, and Lieut. Smith reached him in the nick of time. The latter had to swim for it, as the rowboat he started in was leaky and sank to the bottom.

Captain F. O'D. Hunter and the "bit o'silk" which twice saved his life.

At a luncheon recently held in New York, which was attended by men prominent in various phases of aviation, several of them arose and had their little say. The keynote of the addresses was that the airplane as a vehicle of adventure had about reached the end of its flight. There is no denying the fact that airplane flight has its element of adventure, but doubt lingers as to whether the romance associated with flying will be dimmed to any appreciable extent despite the great improvements which have been and unquestionably will hereafter be effected in airplane design and construction.

It is not the intention here to discuss the future of the airplane, but rather to cite a number of instances to support the contention that flying, particularly in the military service, has its full share of thrills. One may ask why emphasis is placed on military flying, and the answer lies in the fact that the military pilot has a much harder job than the commercial pilot. The latter indulges in straightaway flying only, his task being to transport his passengers, mail and express to their destination in the shortest time possible. He flies over a route mapped out for him and he is thoroughly familiar with the lay of the land.. In the construction of his plane, the commercial type, more stress is laid to the safety factor than to other considerations. For that reason it does not possess the speed or maneuverability of the military plane. The military flyer, on the other hand, must be able to handle an airplane in all maneuvers it is capable of performing. Aerial acrobatics is part of his job, for in time of war he must be proficient in this art if he expects to provide a warm argument for his adversary.

While the safety factor in military planes is by no means neglected, certain sacrifices must be made in that respect to gain the essential requisites of speed and maneuverability. It is part of the education of every pilot, military and commercial, to be able to perform acrobatics, for at some stage of flying by a commercial pilot, when trouble is encountered in the air, such knowledge may prove very handy, much like swimming when some flighty individual should start rocking the boat.

The profession of test pilot in the military service is by no means an easy one. None but the most expert flyers are assigned to such duty, for they must be thoroughly experienced and qualified to pilot almost any type of airplane manufactured. Aeronautical engineers of the present day, through wind tunnel and various other tests, can calculate the performance of an airplane with a surprising degree of accuracy. But theory and practice do not always work out according to expectations. The Air Corps does not believe in taking chances, for the lives of the pilots are too valuable.

When an airplane manufacturer submits to the Air Corps for acceptance a new type of plane, it is subjected to various tests in the laboratory at Wright Field, Dayton, Ohio, to determine the accuracy of design and the strength of its various components. Should it emerge from the laboratory with flying colors, it is turned over to the Flying Department to check up on its performance in the air. It is here that the test pilot has on more than one occasion undergone a thrilling experience.

Several years ago, in a level flight at about 1,000 feet altitude, a test pilot, about to make a landing, pushed the control stick ahead to dive for the field. The plane did not respond, and when he pulled the control stick back which, under normal conditions, would have caused the plane to fly upward, it

was still flying level. These two little maneuvers conveyed to the pilot the unpleasant information that he was without the use of his elevators—that he could neither climb nor land. A thought occurred to the pilot that perhaps the motor could be throttled to make the plane dive gradually, and that it would level out when the motor was turned full on. It took several moments for him to muster up sufficient courage to place the ship in a dive, and he passed through, what seemed to him, a prolonged period of agonized waiting to determine what it would do when he turned the motor at full throttle again. To the pilot's relief the plane slowly but surely righted itself. Again he placed the plane in a dive, this time with more confidence, and when he had dropped to an altitude of about 300 feet he gradually pushed the throttle forward. By a miraculous piece of luck the plane levelled off at precisely the right distance above the ground, and the pilot made a smooth, two-wheel, tail-high landing. Investigation of the controls of the plane disclosed that the small steel band around the control stick, to which the elevators were attached, had broken.

Our 4th Degree Member of the Caterpillar Club.

There is nothing particularly exciting in flying through clouds save, perhaps, in Texas during the early spring, when clouds have a peculiar tendency of falling. An Army pilot and his enlisted passenger, flying near Waco, Texas, had a hair-raising experience when they indulged in cloud flying. After the take-off they climbed to 1,200 feet before clouds were encountered, and, climbing above them, enjoyed flying around for about twenty minutes, with the clear sky overhead and the solid layer of murky mist below. When they started down through the clouds, which by that time had settled so low that at 200 feet the ground was barely visible to the airmen, they came out of them over a number of tall buildings, and had a narrow escape in attempting to avoid some of them.

An Army pilot stationed along the Mexican border demonstrated unusual skill in handling his airplane under most adverse circumstances. In taking off from the airdrome he ran into the propeller wash or draft of an airplane flying just ahead of him which tended to partially deprive him of the control of his plane. As luck would have it, a windmill lay just ahead of him. In less time than it takes to tell of it, pieces of windmill and plane were flying in all directions. Despite the fact that the propeller of the plane was shattered and the landing gear stripped off completely, the pilot managed to make a safe landing, neither he nor his passenger being injured.

One of the expert Army pilots on duty at the Primary Flying School narrowly averted a crash, which bore all the earmarks of proving fatal, by using extraordinary judgment. He was flying a French single-seater Nieuport equipped with a 160 h.p. rotary engine. This little plane, noted for its speed and wonderful climbing ability, was a prime favorite overseas during the war among flyers who were engaged in pursuit work. It did not take him more than a minute to reach 3,000 feet and, desiring to kill some altitude, he placed the little plane in a spin and started down. After a few turns he attempted to straighten out, but the manipulation of the controls in the usual manner availed him nothing. The plane continued to spin and the ground was coming up towards him at an alarming rate. Past experience with a Nieuport developed the fact that it dropped some 250 feet at every turn. Looking over his shoulder the pilot noticed that moving the rudder bar had no effect on the rudder, so he pushed the control stick well forward and applied the aileron in the direction opposite the spin. Using his ailerons and elevators for turning, he returned to the field, headed his craft into the wind to obviate any drift and landed with considerable difficulty. Examination of the rudder disclosed that the wooden block to which both horns of the rudder bar are attached had parted completely from the forward post of the rudder.

Major H. M. Hickam

An emergency parachute jump generally furnishes a story with thrills. Hundreds of practice parachute jumps have been made by Army Air Corps personnel, but no one is particularly keen about making one under the stress of absolute necessity, for on such an occasion the airplane is most likely to be in any but a favorable flying attitude for a safe jump. In a practice jump the pilot generally brings his plane to a stalling position, and the jumper is all set to let go. He may be out on the wing tip holding on to one of the wing struts or half way out of the cockpit ready to kick himself away from it at a signal from the pilot. In an emergency jump, however, the plane may be in a spin, a collision or in some other impossible position, and the imperiled airman must get out quickly the best way he can.

Those who have made emergency

parachute jumps automatically become members of a mythical organization called the "Caterpillar Club." A total of 82 emergency parachute jumps have thus far been made in this country and 77 lives saved. The man who is today foremost in aeronautical circles in this country, if not the entire world, Colonel Charles A. Lindbergh, is also the most outstanding member of the Caterpillar Club, for on no less than four occasions he used the parachute to save his life. Captain Frank O'D. Hunter, of the Army Air Corps, one of the "Aces" in the World War, is a second degree member of the Club, as was also the late Lieut. Eugene H. Barksdale, both of these officers jumping twice.

Lt. Ennis C. Whitehead (left) and Major Herbert A. Dargue

Perhaps the two most unusual emergency jumps of the entire 82 were those made by Majors Horace M. Hickam and Herbert A. Dargue, Army Air Corps, in that neither pulled the rip cord, the device which opens the chute. The days of miracles are apparently still with us.

Major Hickam became a Caterpillar Club member when his little pursuit plane became involved in a dispute with a similar plane, piloted by the late Major Harold A. Geiger, over the right of way in the air. Immediately following the collision both officers took to their chutes and landed safely on terra firma. The accident occurred during a mimic air battle over Langley Field, Va., a formation of pursuit planes being engaged in an attack on some bombing planes. Major Hickam stated that during the course of this attack he heard a loud crash and felt a violent shock, but was unable to determine what had hit him. All the controls of the plane were inoperative, and on looking at the lower right wing he saw that the rear strut was gone and that the spar was folding up.

"Up to this moment, while agreeing in principle with the use of the parachute," Major Hickam stated, "I was not exceptionally enthusiastic about it. However, upon seeing my wing fold up, I immediately became one of the world's most enthusiastic parachute jumpers."

After the shock of the collision Major Hickam's plane continued on an even keel for a second or two, during which time he unbuckled his safety belt and prepared to jump. "The impression I have of myself at that moment," Major Hickam stated, "was that of a slow motion picture. I simply could not move my hands fast enough. I watched them at work but seemed unable to speed them up to any extent."

The plane suddenly whipstalled and started straight down towards the ground. Just then he dived over the top wing, but when he came to he was, strange to say, still sitting in the seat. Resolving then to make a very careful and collected jump with great vigor and energy, the result was the same, as he found himself still sitting in the seat. The unpleasant fact dawned on him that some part of the parachute equipment was caught in the ship and that he would have difficulty in getting out. A fleeting glance at his altimeter showed that he still had some 2,500 feet in which to get out. He realized that he would have to be extremely careful not to become entangled in the tail group of the plane. He would have had no cause to worry on that score had he then been aware of the fact that the entire rear end of the fuselage was broken off in the collision. To add to the horror of the situation, the gasoline from the tank began gushing out in a stream, which meant that should any of this fluid come in contact with the hot engine the plane would immediately catch fire.

"I remember saying to myself," Major Hickam stated, "to keep away from the release ring until I knew I was clear of the plane. I got one foot in the seat and pulled loose with all the strength I had. Just as I got clear of the plane I received a terrific crack which, I believed, was caused by striking the tail group. I immediately tried to kick loose from the wreckage and found myself sitting up in my seat with the parachute completely open. The plane was gliding away from me and I watched it between my knees spin and crash to the ground."

At this juncture Major Hickam stated he took his first deep breath since the collision. He remembered having some faint curiosity at the time as to just how he happened to be sitting in the parachute without having pulled the release ring, but just about the time he was ready to investigate he heard the other plane crash into the ground, and located the wreck. This was the first time he really knew that he had been in a collision. Upon reaching terra firma and examining the parachute, Major Hickam found the release ring still reposing in its pocket. Up to that time he had been under the impression that the ring had caught accidentally in the plane, thus opening the chute. Closer examination revealed that the metal release cord housing had stretched out some two or three feet, causing the re-

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Uncle Sam Tests Engines

By G. H. Dacy

The Government tests commercial airplane engines on a torque stand.

WITH the advent of popular interest in amateur aviation and the establishment of professional flying schools many commercial firms aspire to manufacture new styles and types of cloud cruising engines.

In order to standardize such production as far as possible and to reduce future airplane accidents to a minimum your Uncle Samuel has authorized the Bureau of Standards to test all new engines before issuing any official licenses to manufacturers for the output of such power plants for future planes.

Thus the laboratories and testing fields of the Department of Commerce have recently won new assignments—tasks of measurable importance in reducing the ordinary risks of commercial flying and "joy riding" via the atmosphere.

The airplane engines used in aviation explorations, trans-oceanic cruises, federal mail delivery and for pleasure flying up to this time have consisted of known types that have been tested comprehensively by either our Army or Navy experts. The great majority of these engines were war time and post-war products of standardized style and known capacity and efficiency. They were accepted as safe and satisfactory for many purposes because they were guaranteed indirectly as products fostered by our national defense.

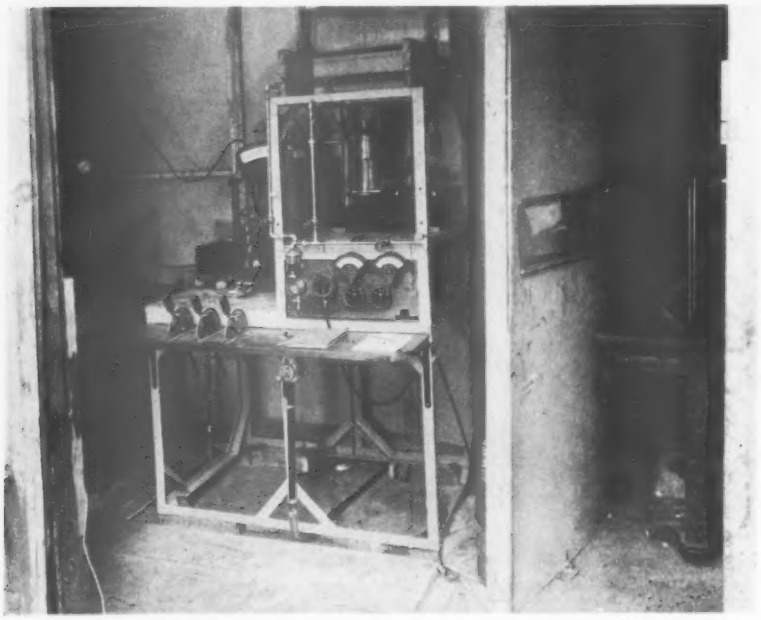
Today in this country there are dozens of manufacturers who plan on the potential production of aircraft engines. Many have introduced innovations, have perfected engines of new types and patterns and have contributed machinery which may or may not write new and startling chapters in the autobiography of aviation. The average layman can best visualize these devices of steel and iron as "mystery" engines. Their merits or defects are unknown. They have not been subjected to thorough tests by any such impartial unbiased agency as the U. S. Government.

Our automotive industry in its rapid rise to fame and fortune made many mistakes, some of which were rectified, others of which have gone to seed as permanent errors. The Department of Commerce is exerting its faculties and facilities to protect commercial flying against similar disasters. The arbitrary requirement that all new types of airplane engines be tested and approved by the Government before being granted the right of commercial production and distribution is a drastic step in the right direction.

All new types of "flying" engines must pass successfully the Bureau of Standards' program of tryouts before they can be certified as airworthy by the director of Commercial Aeronautics, the new ramification of the Department of Commerce. These tests are made at the laboratories out Cleveland Park way and at the Col-

lege Park flying field. In special instances they may be made at the factory of the manufacturer under the supervision of our national automotive engineers.

The manufacturer, first of all, is required to run his new type of engine for at least 25 hours and to keep a technical log of that test. This record must be submitted with the experimental engine when it is turned over to the Government engineers for authorized investigations. This engine is inspected carefully in the federal shops and, if necessary is dismantled for detailed examination.



Instrument board of new type of airplane engine set up in conjunction with engine for test.

Subsequently the engine is mounted in a special torque stand which facilitates "flying" it for test purposes on the ground. The engine is provided with a vertical pitch propellor or a series of propellors and then is operated at maximum speeds. These propellors absorb the power and at the same time produce sufficient air blast to cool the cylinders at different loads. From the resultant data the manufacturer decides the advisable speed at which to rate his engine. The tests also are productive of reliable results which demonstrate what power the engine will develop at that rated speed.

Uncle Sam then subjects the test engine to a 50 hour endurance run divided into 10 five-hour periods. In nine of these tests the engine is run within 3 per cent of its rated speed and must not develop less than the rated horsepower. In the final test it is run at a 10 per cent overload. Finally the engine is installed in an airplane and submitted to a severe service test.

One of the former altitude chambers at the Bureau of Standards is being equipped with the necessary facilities so that potentially all the tests except the actual flying may be performed in the Government "shops." This installation includes an electric dynamometer to absorb the power and an 80 horsepower blower to supply the high velocity air stream necessary to cool the engine.

Each of these engines—sources of future flying power for commercial airplanes—is tested on its individual merits. There are no standard requirements as to fuel and oil consumption per unit of power produced. Sound design, satisfactory materials, good workmanship and reliable performance are demanded before any engine will be certified and licensed. If the engine fails in any of the tests it is returned to the producer with the stipulation that he must redesign and improve it before it will be given a second test.

In the altitude chambers at the Bureau of Standards the airplane engines are tested under conditions analogous to those encountered in actual flight—reduced air pressure and comparatively low temperatures. Air-cooled engines have been tested over a wide range of flying elevations and up to altitudes as great as 30,000 feet above sea level. This "proving grounds" potentially must be enlarged so as to accommodate the modern water-cooled as well as some equipped with superchargers.

The airplane engine tests made at College Park demand fair weather, as the equipment and torque stand mounted at that flying field are exposed to wind and rain. When the equipment is inclosed adequately as scheduled, the engine tests will move forward more rapidly. In each case after the service tests are completed the engine is torn down and examined carefully for indications of overheating, wear, fatigue, lubrication and similar factors which influence flying endurance and permanency of parts.

From 10 days to 3 weeks are consumed in testing out a new type of airplane engine following the thorough program fostered by your Uncle Sam. Our Government is not arbitrary in its demands that new styles and patterns of engines be tried out in this manner. All foreign countries where aviation has progressed rapidly also control by similar supervision the quality of aircraft which they license.

Although the testing of commercial airplanes is a new feature of the routine activities at the Bureau of Standards, its automotive engineers have been studying the performance of aircraft power plants for more than 10 years. As early as 1913 an electric dynamometer was installed and pioneer tests were made on two Reneault airplane engines for the U. S. Signal Corps. Four years later the addition of a 400 horsepower dynamometer had provided for the laboratory testing of the most powerful airplane engines then known. The first experimental Liberty engine now on exhibition at the Smithsonian Institution made its initial test flight on the ground at this Government bureau. The advance of aviation has been so remarkable that it has outgrown the Washington testing facilities and has necessitated the improvements now in progress.

The present altitude laboratory consists of a reinforced concrete room capable of withstanding an ex-

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Revolutionizing Canadian Mining

By E. L. Chicanot

IN the era of civil aviation which opened up after the war Canada has not figured prominently in an international way. This has not been because there has not been a steady and satisfactory progress in aeronautical affairs in the Dominion but because development has been along lines of essentially domestic value and interest. The record of the post-war period is quite a noteworthy one, though of greater importance nationally than to the world at large, and in its accomplishment Canadian airmen have been involved in some of the most spectacular and hazardous flying though this has been done in so unostentatious and routine a manner as to scarcely come to the attention of the Canadian public, much less receive notice beyond the confines of the country.

The peculiarity of Canadian conditions resulted in aviation developing in a manner drastically different from that of any other country. The establishment and extension of passenger and mail services which has taken place elsewhere was not practicable in a country of so few, widely scattered centres. Instead, from the very first, the machine of the air was devoted to the greatest national service, the conservation and exploitation of the immense natural resources which constitute the country's greatest wealth and her hope of future greatness. If Canada has not featured in trans-Atlantic and other feature flying which has occupied international attention it is because she has been too thoroughly engrossed in her own work, setting her own world records. No country, for instance, can approach Canada in the use of the plane in protective forest patrol. The Dominion is unsurpassed in the field of aerial survey and mapping.

Another phase of aeronautics is developing in Canada which promises to become yet more important and of greater scope than these—one which the Dominion pioneered and developed and which she is apparently going to make peculiarly her own. This is the use of aircraft in mineral exploration and development. Though Canada had a mineral production valued at $265,000,000 in 1927 and has produced some of the greatest mining camps in history, in every consideration her era as a mining country is but opening up. But a relatively minute part of the country's tremendous area has as yet been prospected, one might almost say surveyed, and the interest exhibited in mining possibilities today by capitalists of many countries foreshadows immense developments in all sections of the country.

Before this can come about prospecting must be undertaken on a large scale and the minerals found. The search is naturally prosecuted in the wilderness section, the movement being steadily away from the facilities of modern transportation. Far more time is spent in travelling on foot with heavy packs or by canoe than is devoted to the actual search for mineral deposits. It has been very keenly realized that this phase of the mining industry is out of line with modern development, and the vastly stimulated interest in the mineral industry at the present time and the assurance of a prosperous future has given the plane opportunity to introduces itself. It promises to rev-

Fur flying suits are not especially "doggy" up here, they are a necessity.

olutionize very thoroughly the work of mineral exploration in Canada.

Though it seemed extraordinary at the time, it was quite along the lines in which Canadian aviation was developing that the first regular aerial service to be established in Canada should be from the edge of civilization into the wilderness of a new mining camp. It must have been the most unique flying service in the world when inaugurated by enterprising ex-war pilots. It altogether revolutionized preliminary mining development and wrote the opening lines of an entirely new chapter of Canadian mining history. Primarily it substituted a journey of less than an hour spent in comparative comfort in the air for five arduous days of canoe paddling through a forested area infested by mosquitoes and black flies. It actually did a great deal more.

From its base at Haileybury, on Lake Temiskaming, the company undertook to drop passengers or express in any part of the Rouyn gold field where there was a lake, a condition easily met since the area is dotted with bodies of water of varying extent. It carried an average of more than thirty passengers a week, mining promoters, engineers, and prospectors; it supplied this camp so drastically cut off from civilization with fresh fruit and vegetables regularly. The ship of the air travelled over the expanse of virgin forest with freight of every imaginable description—cats and dogs, dynamite, lumber, iron piping, ammunition, pneumatic drills, and gasoline, and on its outward trips mineral samples for assay. According to authorities it set the progress of the new camp ahead by at least two years, and when at length after three years the railroad reached it, more effectively bridging civilization and the wilderness, such reliance had come to be placed upon its performance that it continued to function, competing with the railroad, and carrying out certain phases of transportation in which it had no rival.

It had constituted itself so essential a part of the Quebec field's development that when gold was discovered at Red Lake in Ontario and following a rush a new camp came into existence it seemed the most natural thing that a similar service should be established there, flying from the nearest point of railroad contact over the wilderness to the scene of the new discovery. With the confidence inspired by the Quebec service it was perhaps an even bigger factor in the advancement of the Ontario camp in its first days. Flying boats took in passengers daily so that in record time hundreds of claims were staked out and the camp's progress got under way. The service has been consistently and satisfactorily maintained since and the experience in the Quebec field has been largely duplicated. The aeroplane is pushing this gold camp ahead as no other agency could.

When, last year, a much belated interest developed in the mining fields of Manitoba, which quickly resulted in a general development, the aeroplane was called upon almost immediately to play its part. A company was formed at Winnipeg, with one plane at the outset, which undertook to take passengers or express into any part of Manitoba's mineral area. As development progressed other planes were added and some quite remarkable work was done in the transport of mining machinery and equipment under extremely difficult and dangerous winter conditions. The service has quickly become recognized as a feature of Manitoba mining and the sphere of its activity is steadily extending with the expansion of the northern fields. This summer there are fifteen planes operated by the company in Manitoba's mineral belt, pushing the province's industry ahead.

These services into developing mining camps have been of immense value in more ways than one. They pioneered flying in the remoter sections of the Dominion and through actual experience amassed a vast amount of valuable information on flying in such out-of-the-way places where facilities are of the most

A landing field established on a frozen northern lake.

Practically all of this rig, and the machinery, was transported, part by part, by means of planes.

primitive and resourcefulness counts for so much. They were largely responsible, for instance, for developing and perfecting the ski-runner for taking off and landing on ice or snow in winter flying. They also produced the collapsible canoe which can be folded up and transported handily by plane, which is today considered indispensable to northern flying. They prepared the way for a development of yet greater scope in which the plane moves yet further back in the mining industry and enters the work of exploration and prospecting leading to mineral discoveries. Though this is not entirely new the work is, for the first time, to be undertaken in an organized and comprehensive manner. Though practically nothing has ever been heard of it, the plane has already done some pioneer work in mineral prospecting with such satisfactory results as to augur the greatest success for the broader work. Incidentally, these expeditions, conducted in the most remote and inaccessible regions of Canada, involved flying under conditions as difficult and hazardous as any undertaken on the continent.

The first mineral prospecting expedition by plane ever planned, as far as is known, was undertaken by a syndicate of United States capitalists in the spring of 1925, having for its object exploration work in the unexplored regions of Northern British Columbia and the Yukon. It was no light undertaking, especially from the standpoint of the flying men who were drawn from the pilots who had established Canada's first commercial service in Quebec. The territory to be flown over was completely isolated, largely unexplored, and but very inaccurately mapped. Jumps were made from Prince Rupert, British Columbia, to Wrangell Island, Alaska, thence directly over the coast range to Telegraph Creek, and then over 70 miles of rough country, absolutely devoid of landing places, to Dease Lake, where the main base was located.

With this base established exploration was carried on in many sections by flying on radii from the base and engineers were amazed at the manner in which aerial transport speeded up prospecting. To quote one instance. It was necessary to transport seven men with sufficient supplies to last a month and mining equipment a distance of 200 miles over country quite unmarked by trails and with no sign of human habitation. The whole party and impedimenta was transferred in a day whereas by any other means of transportation such an expedition, if not altogether impracticable, would have taken at least a year. Another trip, which Indians took twenty days to make, the plane accomplished in three hours. At the conclusion of the summer's satisfactory work the party was flown back to the main base and transported to civilization without mishap.

The following year the same flyers joined another expedition instituted by an Alberta syndicate, this time into the Northwest Territories. The party of five flew from Edmonton to Fort Fitzgerald on Slave Lake, and then to a point 400 miles northeast where a main base was established. Intermediate camps and caches were made about 150 miles apart. The region in which prospecting was prosecuted is known as the "Blind Spot of Canada," an immense, desolate stretch of badlands, bereft of verdure. No maps whatever exist of the area and position was determinable only by the sun and the stars. In flying from one cache to another the only guide to the pilot was the countless rivers and lakes as yet uncharted. An entirely satisfactory summer was spent, however, in taking the engineers on radial prospecting trips, all of which were accomplished without mishap of any kind. Before return was made to civilization in the fall an immense volume of work, quite impossible of carrying through without the airplane, was successfully completed.

With the general stimulation felt in the mining industry through Canada and the elaborate plans made for prospecting ore fields it was inevitable, after the experience of the past few years, that the work of the plane should be considerably extended. The search for minerals is naturally taking explorers further and further north, deeper into the heart of the wilderness, increasing the difficulties by reason of the greater distance from civilization and making the work of prospecting by ordinary means yet more slow.

The first movement towards organized mineral prospecting by aeroplane was taken last winter with the formation of the Northern Aerial Mineral Explorations by a well known Canadian mining man with

The office of one of Canada's pioneer airways.

Another temporary landing field on a frozen lake.

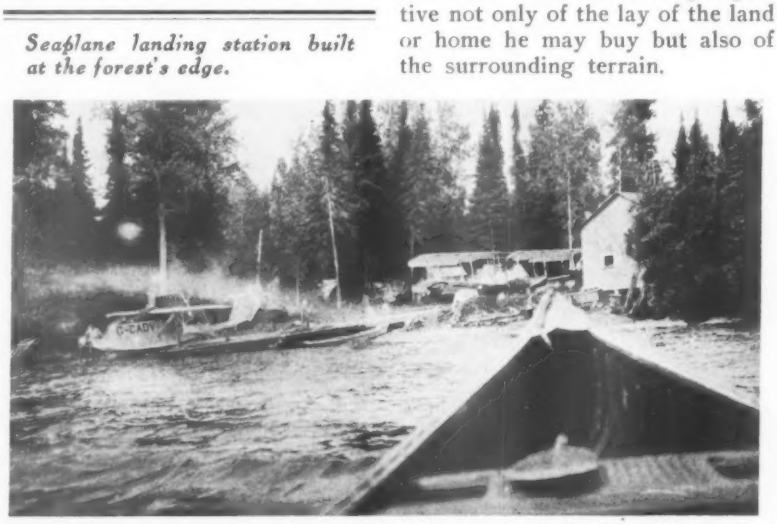
several successful mines to his credit. The company intends to explore thoroughly the mineral wealth of the north by organizing the country from an exploration and prospecting standpoint as completely and efficiently as a large commercial concern does, with head offices, provincial branches, and field forces. From one large central base complete control of personnel, aircraft and radio equipment will be exercised over the company's operations. Bases will be equipped with aircraft of different kinds at centers throughout Northern Canada. Large planes, capable of single jumps of 1,000 miles, will carry prospectors, their supplies, and an extra supply of fuel, to the field chosen for exploration. On that field a base will be established and supplies will be dropped to keep the men for several months. Each base will have two smaller planes and there will be about twenty field parties sent out. The smaller planes will be used to move field parties from place to place in the area they are to cover and with the support of radio keep them in touch with the base.

The scheme which is successfully launched and has arrangements made to cover large areas of Northern Manitoba and Ontario this season is supported by many of the most outstanding men in the mining industry in Canada who have offered the most complete co-operation. It is the claim of the organizer that, given wings, the Canadian prospector, mining engineer and geologist will find more mineral deposits in the next five years than have been discovered in the last half century, and having regard to the manner in which the airplane has speeded up Canadian mining already such a statement is not unduly ambitious.

This enterprise though Dominion-wide and comprehensive in scope is by no means the only one involving the use of aircraft in prospecting in the out-of-the-way sections of the Dominion. Recently two applications for rights to explore by plane for minerals in the Northwest Territories came before the Canadian parliament, one of which has to date been granted. A syndicate which is willing to spend $200,000 on the work has been granted rights to prospect by aeroplane for three years on an aera of about 5,000 square miles 200 miles north of Fort Churchill and inland. The territory is remote from civilization with a few wandering tribes of Eskimos its only inhabitants, no mining man ever having been in there or likely to go in in the ordinary way for years.

The trend is to be noted all over the mining field. Recently a company was organized in the Rouyn field of Quebec with planes at a central point available for trips to mines or for special prospecting parties into distant sections. A mining company in Northern Manitoba recently introduced a plane whereby its management can expeditiously visit the various sections where its developments are located. A mining promoter in the area owns his own plane and flies from his home in Florida to the northern area to visit the various mines in which he is interested. Quite abruptly and definitely the era of the aeroplane in the Canadian mining industry has opened, and having regard to the immense potentiality it cannot be doubted but that this will develop into a leading branch of aeronautics in which the Dominion will have no rival.

Seaplane landing station built at the forest's edge.



Realtor Uses Plane

Discarding the horse and buggy for the automobile and now discarding the automobile for the airplane as a modern means of getting the prospective buyer to the property, has recently been adopted by the P. Kennard White Realty Company of Seattle. Prospective purchasers anywhere within a radius of 200 miles of the city will be taken by the newer transportation, believing that the prospect can also obtain a much better perspective not only of the lay of the land or home he may buy but also of the surrounding terrain.

A New Avigation Instrument

By Andrew R. Boone

THE greatest drawback to correct navigation in aircraft is believed to have been solved with the designing of an instrument by means of which the hour angle or geographical co-ordinates of points on the Sumner line may be observed directly by the navigator at sea. This instrument is the result of research by H. B. Kaster in the

H. B. Kaster designer of the new instrument for navigation.

students' observatory at the University of California.

But what is the greatest drawback? It is quite generally conceded to be the uncertainty of the dip, since the altitude is not known accurately enough for its determination to the desired accuracy and the horizon observed is nearly always a haze horizon, the true horizon being not visible. The ability to eliminate consideration of dip in taking the observation should make the new instrument valuable in navigating airplanes, as well as the elimination of tables in computing while in the air.

When a plane is well off shore, it has been learned, the only accurate method of determining its position is by astronomical observations. An estimate of the position generally can be made by dead reckoning. This consists of observing the speed and heading and estimating the effects of wind currents and other factors. How accurately this can be done was demonstrated by Col. Charles A. Lindbergh in his trans-Atlantic flight.

The result of dead reckoning by pilots sometimes is close and again is greatly in error. Under good conditions the dead reckoning position may be uncertain by only a few miles after a journey of a given distance. Under bad weather conditions this error may be critical. Astronomical observations from a ship at sea usually give the position within one mile, which is 1′ of arc on a great circle. Some ship navigators aim at the 10″ accuracy, to which their sextant arcs are graduated. Such accuracy, however, is seldom realized. Apply the situation to aircraft conditions, where time is a vital element, and one may readily perceive the necessity for rapid and accurate methods of observation.

The line of demarcation between ancient and modern methods of navigation may be placed in 1837. In that year Captain Sumner discovered and began the use of the well known line of position. Hilaire and Aquino have made improvements in its use since that time. Today the determination of position by astronomical observation consists of using a sextant to measure the altitude of some heavenly body.

"If this observed altitude is to be used to determine either a line of position or an hour angle, and hence local time and longitude, or to determine a latitude (except in case of a meridian altitude)," comments Kaster in discussing observations generally, "it becomes necessary in any case to solve the spherical triangle formed by the zenith, pole and object. Dozens of methods have been advanced for the solution of this triangle, any one of which requires considerable time on the part of the navigator under conditions which often are not conducive to mathematical labors."

The instrument evolved has for its purpose the elimination of the necessity of solving the triangle. When

Side view of the new instrument.

Front view of Kaster's new instrument.

used by the navigator he can, for example, read the observed hour angle off the arc without scanning tables for a quarter-hour. However, if he desires to do this, Kaster observes, the altitude can be observed as with a sextant.

The principle of the instrument, as explained by the designer, consists of a small equatorial telescope of the coudé type, the polar axis elevated and the instrumental meridian made vertical by sighting on two points of the horizon approximately 90 degrees apart. This result is obtained by a combination of mirrors which bring into the field of view a part of the horizon directly in front of the observer and also a point on the hori-

(*Continued on page* 80)

Current Comment

Our First Page

We would like to devote our first page, in the future, to the reprinting of what we consider the "literature of the air"—the messages appearing here and there in this country that are helping to make this nation "air-wise." The first one to appear comes from the advertising of the Ford Motor Company. The one man who has done more than any other in "putting the nation on wheels" and in acquainting the city dweller with the country and the country dweller with the city, has turned his attention to the air. These advertisements of his are not aimed at buyers of planes, but at future users of the air. They call the attention of millions to the fact that the conquest of the air is accomplished and that the utilization of it is already here. Characteristically these messages hammer home in practical fashion the business advantages of the air as a transportation medium and the economic advantage to American industry of the airplane and the facilities it offers. They are his contribution to the furthering of aviation.

Speaking of Reading

A few weeks' session with some of the lesser known works dealing with aviation subjects, particularly those on war uses of the airplane, leaves one with a mixture of ideas that are hard to reconcile. It seems to be generally recognized by the authorities that the airplane has given into the hands of man a perfectly terrible weapon of destruction. On the other hand, the weapon is so terrible that the contemplation of what your opponent may do to you in the way of reprisal, if you violate the laws of war, comes close to being a sufficient deterrent and guarantee that the airplane will not be used as indiscriminately for purely destructive purposes as many propagandists would lead us to believe.

If the airplane is to become the cavalry of future wars, acting as scouts, and to be the advance combat units, as well as pure engines of destruction, it seems that we are in for a long season of competitive building. Each nation will attempt to outbuild the others, producing planes of higher ceiling, greater speed and more rapid climb. It may be that some international action will have to be taken, similar to the agreement on the limitation of naval armament and building. Meanwhile, civil aviation progresses, taking advantage all along the line, adapting this feature and that as they are developed by the military and naval air forces, and turning them to the uses of peace and the promotion of prosperity.

This Matter of News

The question of news has always been a puzzling one to *Popular Aviation*. From the start it has been a policy to treat the purely news events in a manner that will serve as a record of events for those who care to preserve their copies for future use. Those of us who have spent many hours looking over the few existing files of "Aero" and other pioneer aviation magazines know how interesting these records of former days can be, and what thoughts they bring of the early days when flight was an amazing performance to everyone.

However, long flights are becoming a commonplace to a certain extent. As has been cynically said by more than one pilot, it will take a round the world non-stop flight to cause any great furore. Seriously, though, it requires some explanation to our readers when they open the latest copy of *Popular Aviation* and see space devoted to events that have been read in newspapers a month before. It takes time to print well over a hundred thousand copies of *Popular Aviation,* and it takes still more time to distribute them over the entire country and to get them to the thousands of news stands. News cannot be anything but old to many of our readers by the time this process has been completed.

The record is there for those who wish to preserve it, and we will not deviate from our plan of presenting some sort of record for preservation. A change will be made in the method of presentation, and a brief form of summary will be adopted. We mean this in no jaded spirit regarding the latest and bravest accomplishments. We simply believe that our readers

Current Comment

will prefer to take their news from the newspapers and to secure information of a different sort from these columns.

Regularity

One of those little things that go a long way toward selling aviation to the public was recently demonstrated to the writer. Ever since daylight saving time has enabled him to get in nine holes in the evening, he has noticed that promptly at ten minutes of nine, every evening, the N. A. T. mail from the West has flown over the club house. At that time the dining-room is full of late golfers, and as the roar of the motor is heard, most of them glance at their watches and make some comment. The reputation of the air mail for punctuality has become a matter of comment. Each day a proof of the regularity of the service is offered. Each "on time" flight has sold aviation a little more to each man who notices the silver shape in the sky and hears the roar of man's most efficient means for getting from one place to another.

Miniature Aircraft—Meet

The time is rolling around when the youngsters will again meet for the National Tournament held under the auspices of the Playground and Recreation Association of America. These boys are future flying material of the best sort. If you do not believe it, or if you are inclined to look down the nose a trifle at this sort of enthusiasm, just take time to ask some of the old timers if they ever flew models. You'll be surprised!

Readin' and Larnin'

A correspondence school pilot is a well-worn figure of the comic strip, but where there is a laugh you will frequently find something serious. You can't learn to make a three point landing by reading about it, but you can make it easier for the man who is to teach you how to make that landing. Study of theory, simple construction, operation and the many other things that a flyer must know can be gained from books, if carefully selected and written by reputable and experienced men. It is the story of the carefully schooled man. He gets a later start, because he has spent time in obtaining a theoretical knowledge of his work. When he reaches the practical stage he is behind the men who have been at the practical matters while he has been at school. But business men tell us that he soon outstrips the others and goes further and higher. It is not too far fetched to claim an analogy for matters aeronautical. The Army and Navy seem to prefer the men with book "larnin'."

Municipalities Note!

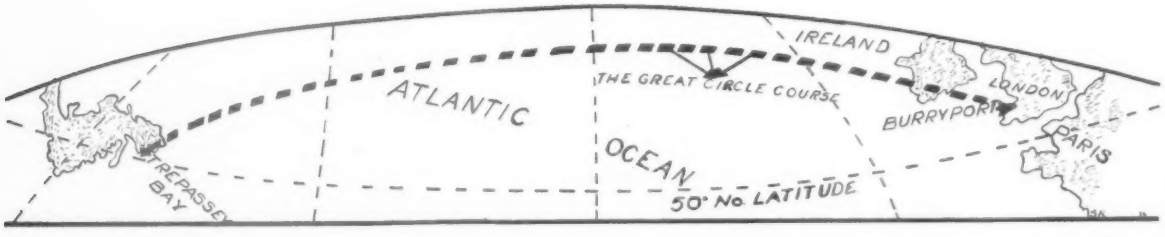
A little money spent on accommodations to take care of the visitors to flying fields and air ports will bear dividends. From all sides come complaints that no provision is made for the throngs that are to be seen daily at any of the great air ports of this country. These people are potential purchasers of aircraft or future passengers on air lines. Now they are herded about in the mud, or dust, and it is a poor advertisement of air transport as a going business. The appearance of most fields conveys no impression of orderliness or that efficient organization that our public demands of its transportation companies. Abroad, they have managed to take care of visitors and in Germany seem to make small profit out of them. Municipalities might well study these foreign methods. They will receive the whole-hearted co-operation of the companies using their ports.

That Matter of Home-Building

No one would consider building an automobile today. Rebuilding or conditioning is a different matter. For some reason there seems to be no end to the crop of people who feel that a little mechanical ability is all that is necessary in order to construct an airworthy plane that can be flown with the utmost safety. With so many companies planning production it will not be long before the home design of an airplane will be considered as strange as backyard auto building.

The Atlantic Again

Took off 3:52 p. m. June 17th from Trepassey Bay, Newfoundland; landed 12:41 p. m. June 18th at channel waters near Llanelly, Wales. Total time 20 hrs. 49 min.

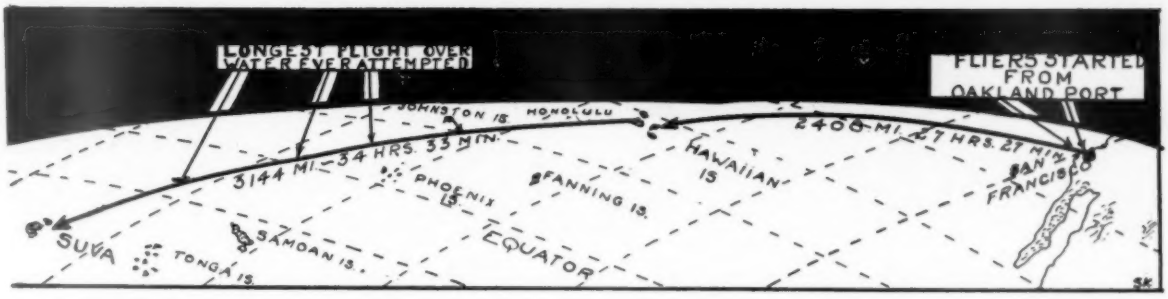


Miss Amelia Earhart
Passenger

Wilmer Stutz
Pilot

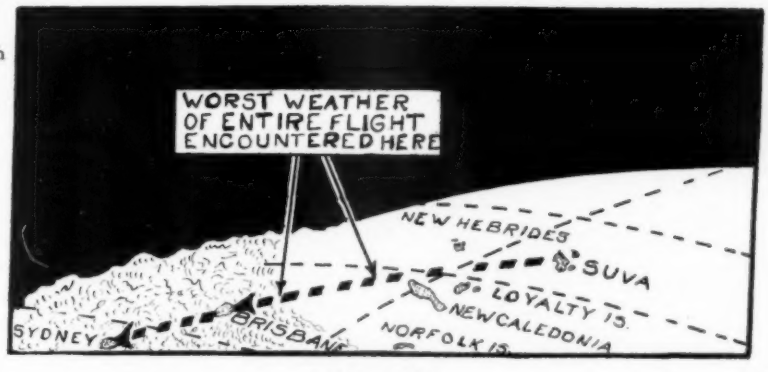
Lou Gordon
Mechanic

"Westward Ho!"



Capt. Kingsford-Smith
Pilot and Commander

Capt. C. T. Ulm
Co-Pilot and Organizer



Harry W. Lyon
Navigator

LOG OF FLIGHT

	Start Time	Landed Time	Distance and Hours
First:	Oakland Airport, San Francisco, Calif., May 31	Wheeler Field, Honolulu, Hawaii, June 1	
	Thursday, 8:52 A. M.	Friday, 12:18 P. M.	2400 miles 27 hrs. 26 min.
Second:	Wheeler Field, June 3	Suva, Fiji Group, June 4	
	Sunday, 7:50 A. M.	Monday, 6:23 P. M.	3130 miles 35 hrs. 37 min.
Third:	Suva, Fiji Group, June 7	Brisbane, Australia, June 8	
	Thursday, 6:40 P. M.	Friday, 4:10 P. M.	1795 miles 21 hrs. 30 min.
Fourth:	Brisbane, Australia, June 9	Sydney, Australia, June 9	
	Saturday, 4:00 A. M.	Saturday, 9:08 A. M.	500 miles 5 hrs. 8 min.
Total:	San Francisco, Calif., May 31	Sydney, Australia, June 9	
	Thursday, 8:52 A. M.	Saturday, 9:08 A. M.	7825 miles 89 hrs. 41 min.

NOTE: For the Sake of clarity, Pacific Time is used throughout.

James W. Warner
Radio Operator

Pioneer Air Pilots

Charles K. Hamilton

By Albert Buranelli

"DOWN, down, down I went. The rush of air was so great I couldn't breathe. Suddenly when the city loomed up directly below me, and I thought every second to be smashed into a thousand pieces, the gas bag of the balloon spread out like a parachute. It was only an accident that it did so. It had been cracking and flapping above me, making a terrific racket, and how or why it spread out two hundred feet above the ground instead of six hundred feet or ten—when it would have been too late—no one will ever know. It did spread out, however, and that saved my life.

"My fall was not stopped, but the parachute made by the gas bag broke it to such an extent that when I crashed upon the roof of a hotel I was simply knocked unconscious. Part of the engine went through the roof, but within five minutes after it struck I was able to get up and walk away. Not a bone was broken, but the shaking up I got was so terrific that I had to spend the next three weeks in a hospital. Of course I was covered with bruises, but I wasn't really badly hurt."

In a matter-of-fact fashion Charles K. Hamilton thus described a fall he had at Paterson, N. J., in 1905. It was but one of many. He fell at least sixty-three times in balloons, gliders and planes; and there was scarcely a part of his anatomy that, at one time or another, had not suffered. It is rather ironical to note that "Daredevil Hamilton" died, as he had always maintained he would, in bed.

Hamilton was born on the 2nd day of May, 1881, at New Britain, Conn. According to the extremely meager accounts of his youth he took to the air "as a duck takes to water." His first attempt at "avigation"—he was eight years old at the time—consisted of a leap from a barn roof with his mother's parasol as a sustaining surface. His first fall! It marked an epoch in his life. Small, red-headed, freckle-faced he was the pugnacious leader-in-mischief of his neighborhood; yet a certain originality of thought and action made him stand out against the rather prosy background of his surroundings. He seemed to have no inclination to labor in the orthodox ways, and thus he was pointed out as a ne'er-do-well. He was his home town's "terrible example."

In his 'teens he devised a glider of sorts. While testing it he collided with the district grocer, who happened to be passing; wrecking a basket of comestibles and that gentleman's dignity as well.

"That boy will kill himself with his crazy notions," the irate shopkeeper observed to the culprit's mother. The tradesman, it is to be assumed, received scant attention from her; she was in sympathy with her son and encouraged him to continue his experiments. His father was not so lenient, and finally, at twenty-one, Hamilton set forth to make his way in the world.

Just how he was occupied during the next several years is not known. There is some vague men-

This Man Might Well Be You!

A few weeks ago Pilot McDonald worked in a small town without much chance of really getting anywhere. Today, after taking the C. A. C. aviation course and backed by our Welfare Department, he has a position in the World's greatest and newest industry, aviation. Read what pilot McDonald says in his letter at the right. Just as a story of success, this is interesting. But to you it has a greater significance.—**This man might well be you.**

There is no need to tell you that aviation is the world's newest and greatest industry. There is no need to tell you of the big success men are making today in aviation. The fact that you are reading this magazine shows that you know this. Why are you not making steps right now to get in while it is still young? Are you willing to sit idly by and see others take places in this field that should belong to you?

Stop wishing about aviation. Take some action. Decide for yourself now whether you do or do not want to get into this field. If you do not let that end the matter. If you do, we will help you.

Chief Pilot Bassett has written a big book on aviation—we are willing to send you a copy free to help you get started.

Read Pilot McDonald's Letter

"Due to the fact that I am about to complete my flying test, I feel that this is the opportune time to express my sincere appreciation of your wonderful School and the help it has been to me in securing the position I now have at the Municipal Airport.

"Your patience and skill during my instruction has made me very competent and able to hold the job and to be fitted for the opportunities there are here in the way of promotion.

"I shall certainly be delighted to recommend your School to anyone interested in Aviation and I hope that they will have the good luck of getting their instruction under such capable and experienced instructors as are connected with the Chicago School of Aviation. Wishing you success, I am

Very truly yours,
W. H. McDONALD.

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The Chicago Aviation Company operates off the Chicago Municipal Field where the air mail lands. Every instructor is a transport pilot. Only new production, modern planes are used for instruction. Complete ground work is given in our large down town factory. Above all, the C. A. C. flying plan is the only guaranteed course of training giving you Unlimited Flying Time which assures you that you will be a pilot.

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tion of him as an acrobat in a circus; as a professional parachute jumper; as a fiddler—fiddling for his living. They all sound logical enough. He was athletically inclined; he had a penchant for the air; and he had taken violin lessons in his youth. At any rate, in 1904 he met up with Israel Ludlow, a New York lawyer. Ludlow was experimenting with gliders, and Hamilton went to work for him.

Charles K. Hamilton—Can any one identify the time and place of this photo?

The only suitable space in the city that Ludlow could find for the tests he contemplated was at the foot of West 79th Street; there an eight hundred foot dock projected into the Hudson River. Three blocks away an old Colonial house stood. The gliders, made of bamboo and light canvas, were built in its rear.

The first machines built were tested with ballast, and it was not until 1905 that Hamilton essayed a flight. On the trial of the fifth contrivance he met with a mishap. The glider was attached to an automobile—an eighty H. P. car was required to lift it into the air—with two hundred feet of hemp rope; fifty feet was coiled in the rear to insure a running start. Hamilton perched himself on a rope seat immediately in the rear of the front planes; Ludlow mounted beside the chauffeur, and the car was sent racing for shore. The glider rose about one hundred and fifty feet; but instead of gliding, the machine dived and was completely wrecked. Hamilton escaped uninjured.

A flight down the Hudson was next tried. Ludlow hired a fast tug; the glider, resting on the shore end of the dock, was attached; at its fastest pace the boat headed for mid-stream; and the glider rose into the air. The tug then turned down river, and for a mile and a half Hamilton soared two hundred feet up. A ferry boat in its path forced the tug to slow down, and Hamilton glided down and settled on the icy water.

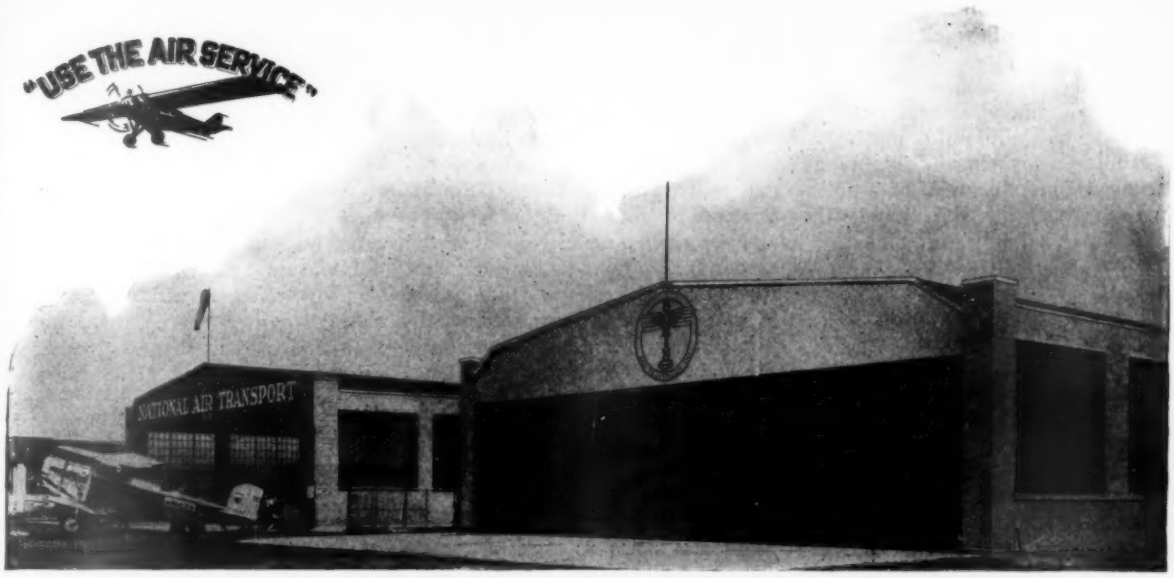
In January, 1906, he went south with Ludlow to attend the races sponsored by the Jacksonville Auto Club. While soaring at Ormond Beach on the 14th he met with his first serious injuries. The machine struck a flag pole and fell sixty feet, knocking off a corner of the Bates House in its descent. Hamilton landed on his chest; broke two ribs; and suffered a few dislocations. He was conscious when help reached him.

"Dammit; I lost my cigar," was his sole comment.

In a comparatively short time he was up and about again, and he toured this country, Mexico and Japan giving exhibtion flights in dirigibles for the next several years. In the latter country he was received by the Mikado, and on the day that Bleriot crossed the Channel—July 25, 1909—he navigated his somewhat unwieldy craft across the Bay of Osaki. In October he returned to this country.

The airplane had made rapid advances since Hamilton's glider days. He readily recognized the superior advantages of the heavier-than-air machine in exhibition work, and it now occupied his thoughts exclusively. Glenn H. Curtiss had a flying school at Hammondsport, N. Y., and there Hamilton went. His first flight was made on the 26th of November, 1909. He proved to be an apt pupil. Within less than a month he was doing exhibition work for Curtiss.

During the week of December 12th, he flew at St. Joseph, Mo. It was intensely cold; the weather was raw and blustery; but it did not deter Hamilton. He bucked through it all; flying, for lack of a better place, from the frozen waters of Lake Contrary; and he came through safely except for a skinned nose which he received in



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a minor crack-up on the 16th. The next week he flew at Overland Park, Kansas City. A more serious incident happened there; although Hamilton himself was in no danger. While floating in to a landing the wing of his plane struck a constable who was policing the grounds. Fortunately the man was not badly hurt.

During an aviation meet at Los Angeles, Cal., in January, 1910, Hamilton took a five hundred dollar prize for making the slowest lap of the field. Here he learned the maneuver that he introduced to the public as the "Hamilton Dip." He was at an altitude of six hundred feet when his crankshaft broke. Instantly he shut off the motor, and tilted his elevator so that the crippled plane dropped steadily and evenly downward to earth. As he neared the ground he reversed his controls, and landed. He liked the sensation of the thrilling drop, and therafter included it in all of his exhibtion flights.

On the 24th of January Hamilton flew from San Diego to Tia Juana, Mexico. It was then a hazardous non-stop flight of twenty-six miles; part of it over the Pacific, and out of sight of land. Leaving San Diego he gave exhibitions at Bakersfield and Fresno, Cal.; Phoenix and Douglas, Ariz.; El Paso, Texas, where he became lost and dropped into a startled farmer's backyard for directions; Portland, Ore.; and Seattle, Wash. At the latter city, on March 12th, while over Lake Washington, he swooped down in his favorite stunt from a height of eight hundred feet. Something went wrong, and the plane hit the water at a sharp angle. It was wrecked, and Hamilton was badly cut and shaken up. The 6th and 7th of May found him flying at Atlanta, Ga.; on the 11th he gave an exhibition during the auto races at Augusta; he flew at Jacksonville, Fla., on the 21st and 22d, at the Moncrief Park Race Track where he raced with a Cadillac automobile driven by Claude Nolan, under whose auspices Hamilton appeared.

He reached New York on the 29th—the day that Curtiss flew from Albany to the City.

Hamilton now approached the apex of his career. A ten thousand dollar prize was offered by the New York Times and the Philadelphia Public Ledger for a round trip flight between their respective cities. That was the plum he aimed for. He made his headquarters on Governors Island, and began preparations. Late in the afternoon of June 11th he went up and swooped and circled over the harbor for an hour and six minutes, thrilling the thousands that gaped in wonderment. Darkness brought him down; but he was satisfied. He would win through.

The morning of the 13th dawned hazily on Governors Island; but the rising sun rapidly cleared the air, and when his machine, a Curtiss biplane, was trundled out for the start a beautiful summer day greeted it. A large crowd was on hand to watch the take-off. Because of the water hazards along the line of flight Hamilton had encircled himself with inflated bicycle tubes, and he presented a grotesque appearance as he took his position at the controls. A leather coat completed his flying costume; he wore neither goggles nor helmet. He carried, among other things, a letter of greeting from Charles E. Hughes, Governor of New York, to Governor Stuart, of Pennsylvania.

Popular Aviation wants its readers to know that photographs and anecdotes of the "Old-Timers" are desired. A complete and permanent record should be kept of the pioneering days of flight and your assistance is sought.

When Hamilton opened his throttle the hands of a gigantic clock across the bay on the Jersey shore pointed to 7:11; but in spite of that lucky combination he did not get far. Literally and figuratively, he hit a snag. It resulted in a broken propeller. An ominous date and an ominous beginning, said the superstitious. The only propeller available was on the plane that Curtiss had piloted down from Albany. Willing hands set themselves to the task of transferring it to the disabled plane.

At twenty four minutes to eight Hamilton finally got away. He climbed to two hundred feet, circled his starting place and then headed south. Shortly after reaching the Jersey shore he sighted the special train that was to guide him waiting on the Pennsylvania tracks. Exactly one hour and fifty minutes after his start he landed at Philadelphia amid the vociferous cheers of the waiting crowd.

"Has anybody here got a match," he requested, as he clambered stiffly to the ground. His thick red hair was matted with grease and grime, his face was streaky with oil and his unprotected eyes were inflamed. As he smoked he relaxed, and after listening patiently to sundry oratorical flourishes he went to luncheon.

The return journey began at eleven thirty-three. He had a tail wind. Suddenly a cylinder began to sputter. Hamilton turned his attention to the recalcitrant engine; and in so doing lost sight of his railbound guide. He swung away from his course; a second, a third cylinder cut out on him. He had to descend, and landed in a marsh at South Amboy, N. J. For the second time his propeller hit a snag and smashed.

"Hamilton stuck in the swamps at South Amboy" was the message that went over the wires. Another propeller was immediately dispatched by automobile. In the meantime, Hamilton supervised the removal of the plane—it was carried bodily by the awed spectators —to a nearby roadway. At six twenty he took off from the highway, and twenty minutes later rolled to a stop on Governors Island. In spite of his difficulties he had succeeded.

The "terrible example" returned to his home town on the 2nd of July as its guest. The governor of the state and his staff were there to greet him, and the whole town turned out to do him honor. Engine trouble dogged him in his flights there, and he crashed twice.

While flying at the State Fair grounds at Sacramento, Cal., on the 9th of September, Hamilton's rudder jammed. In the ensuing crash his legs were pinioned under the hot radiator of his engine. He was so badly injured that his

Ancient and Bullet-Riddled
—Still flying every day in Nicaragua

When the Marines landed in Nicaragua, according to Major Brainard's story in a recent issue of "Collier's," they found two young American Soldiers of Fortune, Messrs. Mason and Brooks, comprising the personnel of the Nicaraguan Federal Air Forces.

TWO SWALLOW PLANES, ancient and decrepit, were their equipment. In these two old-time planes, on which they had mounted antique machine guns, Mason and Brooks sallied forth daily to "straf" the enemy with machine gun fire, and drop home-made bombs in their ranks. They had to fly low—and daily more bullets pierced the old Swallows.

But still they flew—these old-time Swallows, and brought their pilots safely back after each sortie, over mountains and jungles—back to Managua, where their intrepid pilots would climb out and count the additional bullet holes from their latest tilt with the enemy.

What finer tribute could be asked of the staunchness of these ancient Swallows? How many years they had been in service—what their experience before reaching Nicaragua—no one knows. Yet even in these old models, Swallow engineering principles were right—proven under the hardest kind of service.

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life was despaired of; yet such was his remarkable recuperative powers that within less than a month he was up and about again.

In his youth Hamilton had been pointed out, among other things, as being thriftless and improvident. On the 4th of October he settled that score. On that day he walked into a bank in his home town and dumped five hundred twenty dollar gold pieces on the desk of the astonished cashier. Thus he gave the lie to his traducers.

The last week in October was set for the Belmont International Aviation Meet. What a galaxy of heroic names: Orville Wright, Latham, Grahame White, Audemars, Brookins, Ely, Arch Hoxsey, Ralph Johnstone, Bud Mars, Drexel, Moisant, Garros, P. O. Parmalee and Slim Shriver, to mention only a few. Hamilton was there also. The following impression of him was taken from a contemporary account:

"Short, thin, with the cheek bones almost piercing through the flesh on his face, so emaciated has he grown since the accident which fractured his jawbone and scalded his legs severely out west last summer, Hamilton's is not a figure which would attract any great degree of attention were he to be found walking down a street among a crowd of strangers. But from the top of his ruddy head to the toe of his boots C. K. Hamilton is unanimously conceded to be one of the most genuine articles ever encased in a rubber coat and leather breeches. Entirely real in his attitude toward the world at large, absolutely simple in his manner with whomever he comes in touch, Hamilton is regarded as a prince by all who know him. His strong sense of humor and his ready tongue are characteristics which make the man an individual, rather than a type. His reputation rests . . . upon a series of exhibitions in which a marvelous ability as a 'driver' has been demonstrated, as well as a demoniacal tendency to flirt with death."

Shortly after the meet Hamilton began a tour of the south with "The International Aviators," an exhibition organization, which numbered Moisant, Garros and Audemars among its members. On the 10th of February he flew over the beseiged city of Juarez, Mexico. At Monterey he got into trouble, and was thrown into jail. During that time he had nothing to eat, and what was worse—for him—nothing to smoke. Two hundred pesos slipped into the proper palm obtained his release after two days. He made tracks for Vera Cruz and returned to New York.

Soon after his return Hamilton bought a new Burgess Wright biplane, and towed it to New Britain. He flew it to Hartford on the 19th of June, and, buzzing around the dome of the capitol, disrupted the sober deliberations of the legislators. For the next eight months there was little in the news of Hamilton. Then on February 20, 1912, he reappeared in his usual roll by crashing at Jacksonville, Fla. That placed him out of the running, temporarily, with a broken leg. It was his last serious crack-up.

As the aftermath of an aviation meet held at Boston in September, in which he participated, Hamilton sent in his resignation to the Aeronautical Club of America, and requested that his name be stricken from its list of pilots. A troublesome period now ensued. It finally resulted in a nervous breakdown. In July he was removed to a private sanitarium in New Britain. Upon his recovery he resumed flying. He married his second wife, Miss Augusta A. Lawson, on the second of October; his first wife had divorced him the previous year. After his marriage he maintained a hangar in the Bronx for his flying activities.

About three o'clock on the morning of January 22, 1914, an ambulance from the Knickerbocker Hospital drew up before 225 West 109th St. Mrs. Hamilton had awakened to find her husband groaning and unconscious; he was bleeding from the mouth, and she hurriedly summomed assistance, but it arrived too late; Hamilton had taken his last flight. He was dead from an internal hemorrhage.

Thus died the man whose epitaph might well be written:

"He kept his promise—he died in bed."

Women and Flying

By Margery Brown

ARE you a woman, and do you want to learn to fly?

Then, my advice is—fly!

From conversations I have had with women I have come to the conclusion that flying, to them, is more symbolical than to men. To many men it is merely mechanical; to women it seems to signify rising above their environment in one way or another.

If anything bespeaks freedom from limitation, flying certainly does. I believe it symbolizes, to women, freedom from the irking limitations that have hedged them about for so many centuries.

If you are a woman, and feel a really strong urge to fly, quite likely flying will satisfy an emotional need; it will help you to become better balanced emotionally by releasing impulses that crave expression.

Flying appeals to a woman's emotional or romantic nature more than to a man's, for at heart, most women are poets, and flying truly is poetry in motion. To fly, is to live metre and rhythm!

They say that almost anyone can learn flight, with the proper instruction. If you can drive an automo-

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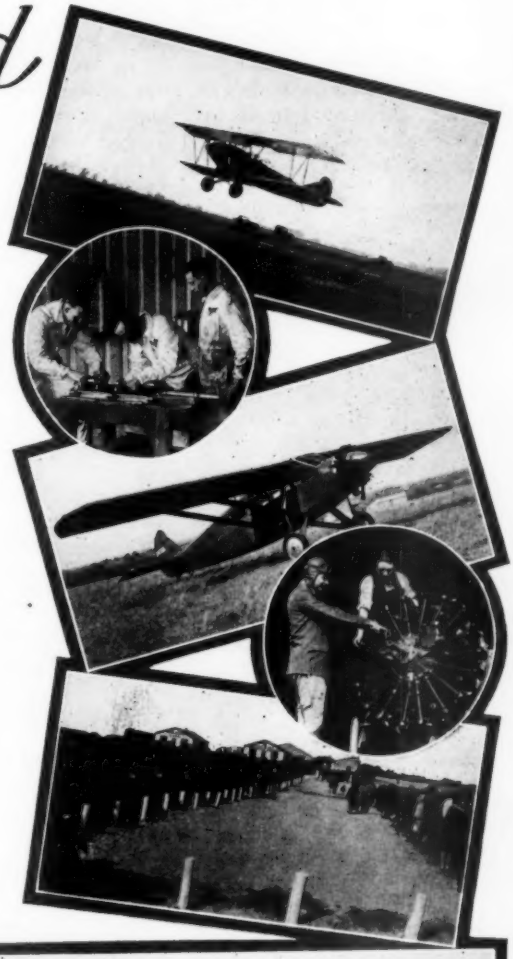

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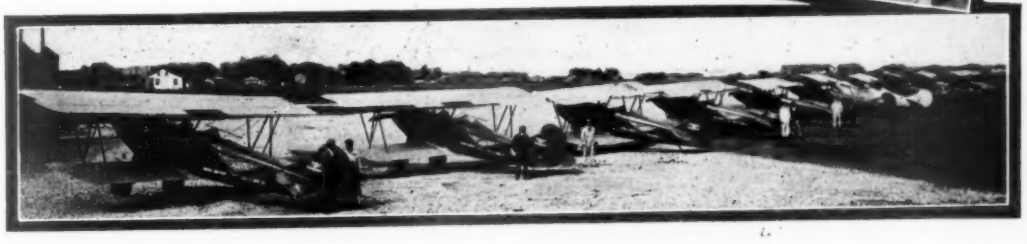

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bile, so much the better; you will learn to fly more quickly. It will be easier for you to learn than it was for me, because I never bothered learning to drive an automobile. Driving teaches you to concentrate and to pay attention. It is tremendously important to be alert and to pay close attention, when you are flying.

Perhaps you think that you would be afraid? You wouldn't be, after the first three or four flights, for you soon develop a "flying sense," and a few thousand feet above the earth comes to seem quite a natural place for you to be.

Lieut. Kitchingman, who has taught more women to fly than any other instructor at Curtiss Field.

One woman who was just beginning a course of instruction, said to me, "I know I'll be petrified with fear the first time I have to fly alone!"

I assured her I didn't think she would be.

After she'd made her solo flight, I asked her how she had felt. She replied that she experienced just a moment of fear when her instructor stepped from the cockpit; but as soon as she was really started on her first flight alone, all fear vanished. I believe this is a rather usual experience, and no doubt it would be the same with you.

You might encounter some discouragement, as men to a certain extent still seem to disapprove of women invading the flying fields, but they may as well resign themselves to the inevitable, as women are going to fly; yes, and very soon, and in large numbers! Men think that a woman's place is in the home, but men don't seem to understand that in these days of improved household devices and competent service, there is precious little to occupy a woman in the home.

Women, as a class, have too much time on their hands, and they need active work to absorb their energies. It is far healthier to tire yourself out in the open air at a normal occupation like flying, than it is to get fagged out and weary dancing for hours in a hotel tea-room, or in a stuffy night club. And it will thrill you thirty times more than questionable excitements do, which fade into insignificance in comparison to the legitimate thrills you will derive from aviation.

There is this to be said in its favor; through flying you will develop interests you'll never acquire around a bridge table, or in a beauty parlor. Flying will help you to get your mind off yourself; it will enable you to fasten your attention on the wider type of interests which men have always had, and which are largely responsible for the fact that men, as a sex, are less restless and far more satisfied with life than women are. Men have always had more fun than women, because they are less dependent on the personal element for happiness! Flying will help you to eliminate that personal element.

On the flying field they say that women won't make good flyers because their reactions are inherently feminine; they are changeable; can't be depended on; don't "stick" at things; can't make decisions for themselves, and so forth. These so-called feminine qualities are merely superficial. It remains to be seen whether women will become enthusiastic enough about flying, to make the effort to overcome temperamental faults that interfere.

It is interesting to note Colonel Lindbergh's reply when someone questioned him concerning the possibility of women taking up aviation as a career.

"The women in Europe have shown ability to do in the air whatever men can do," Lindbergh said, "and I expect they will prove equally progressive in this country!"

At present women are becoming interested in flying mainly as a sport, but recently I talked to two women who are learning to fly with the hope of being able eventually to commercialize their knowledge of aviation. One woman declared that she would ask nothing more thrilling than to become an aerial photographer; the other woman aspires to head a flying field one of these days!

If you want to learn to fly, you can begin right now, right where you are, to acquire some of the qualities that are essential. Begin trying to be careful, accurate and thorough. Whatever you are doing, no matter how unimportant it may be in itself, concentrate your attention on trying to do it accurately. Even if it is something you don't like to do, curb your impatience and do it accurately. They say that about eighty per cent of the mishaps in aviation result, not from motor or structural failure, but from carelessness or inattention on the part of the pilot. Therefore it is quite easy to see that anything which teaches you habits of carefulness and accuracy, will be helpful when you begin flight instruction.

Many have asked me, "What is it like in the sky? How do you feel?"

I suppose people react differently, but I feel as if I am being lifted above annoyances into a realm of happiness and freedom. There is

(*Continued on page* 87)

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This Fighting Game

By Lt.-Cdr. F. W. Wead, U. S. N.

DEAR BILL:

You have asked me to give you the latest dope on the fighting game as we have worked it out out here on the west coast. That's a large order, but here goes.

First of all, after considerable experimentation we have adopted the 3 plane section in V as the basic unit. Larger formations are built up in V or in echelon by compounding these sections. About 9 planes, however, is the most that can be easily handled by a single leader. Larger formations are clumsy and complicated. If more than 9 fighters are sent out on a single mission, the rear groups of nine merely conform in general to the movements of the leader in order to maintain contact with him, and do not attempt to follow his signals for changes of course and the like. Changes of course and formation are made on signal, though with well trained and experienced pilots it may be possible to omit the signals. V of Vs and echelon of Vs are about the only formations required, though planes may be placed in echelon for shooting or bombing or strafing in succession. In actual war work, however, planes will naturally fall into echelon from V or echelon of sections, and it will not be necessary to put them there before attacking. Radical changes of course are made by cross-over or reverse turns, and smaller changes are made without signal in the normal manner but without banking; sort of washing around, flat. Any fighting formation or maneuver should permit pilots to devote a maximum of attention to searching the sky; number 3s should search the right hemisphere, first above, then through, then below the wings from nose to tail; number 2s should similarly search the left hemisphere, leaving number 1s free to concentrate on the most probable enemy location.

Combat can best be taught by pairing a green and experienced pilot, both planes being equipped with camera guns and time registering devices. There has been much agitation and talk about fighting in formation, and some of the boys have been visioning huge formations of fighters diving together on other large formations, pulling off for subsequent attacks, maintaining their relative positions, and similar rot. It may look pretty on paper, but it isn't being done in the air. On the other hand, the formations do serve a definite purpose; they get the planes there together, and a few general rules can be laid down which may give us a considerable advantage in starting an attack. Once started, a series of dog fights is bound to develop, and from there on it is going to be the snappiest pilots who come home with the bacon.

In the simplest phase of combat, one fighter against one fighter, let us assume that fighter A has the altitude advantage over fighter B. A dives on B, and nothing B can do can keep A from getting out a burst on him. A should get B in that burst, but probably won't. B should turn, climbing full gun, and head directly towards A; this gives B a little protection from his engine, pulls A over on his back, giving him the shortest possible burst, and by pulling up B may be able to get a burst out at A. As the two ships pass each

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In doing this, we are simply urging Congress to follow, without delay, in the footsteps of the Canadian Government, which supplies an airplane **gratis** to every civilian flying club. In fact, Canada goes further than this—for Canada pays each club $100 for every pilot turned out.

$40,000,000 Jokes

$40,000,000 will provide 10,000 modern airplanes for training purposes. This is less than the cost of a first class battleship. And as an editorial in one of America's greatest newspapers recently pointed out—battleships are fast becoming a joke. *What this country needs, and hasn't got, is the world's best fighting AIR Fleet.*

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The American Society for Promotion of Aviation was organized by 12 ex-service aviators at the Army & Navy Club, New York City, in 1925. It is a voluntary non-profit organization incorporated, and maintained

To "Arouse and promote interest in aviation, as our strongest army of National Defense."

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Yes I am interested, and I want to add my name to the thousands already enrolled by you in your petition to Congress to provide funds to furnish airplanes gratis for civilian flying clubs, organized under the auspices of the ASPA or other accredited aviation organizations. Dept. PA

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This shows how "A" maintains his initial advantage and position over "B."

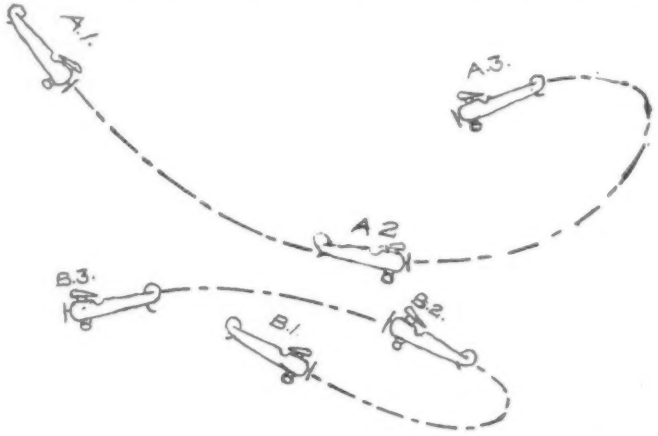
other, both turn, trying to get their guns to bear. A should also have an advantage during the first few turns. A series of eights usually develop, each plane momentarily heading towards the other, possibly getting out a few shots; then they pass over and under, and at once turn towards each other, and so on. If one pilot beats the other to a turn, a close circle, chasing tails, will develop. In this close combat, if planes and pilots are nearly equal, only snap shots will be obtained. If one plane has a superiority in speed, climb, or turning, that plane will normally win. Speed enables one to pull in from the outside on to his opponent for a burst without stalling; climb enables him to work gradually up above his opponent and then pull down and in for a burst; if he can turn inside his opponent he can loosen his turn to bring his sight on, pass across his opponent's tail and then pull back in, sights bearing all the time. In this close fighting a few feet means a lot. As I have told you before, it seems to me that climb is the most desirable characteristic in a fighter, other things being nearly equal, as altitude not only gives the first advantage, but can at once be converted into speed or position. That, and the fact that they are light and handle fast and easy, is why I am so keen about the air-cooled jobs. Once A has closed with B he should stick with him until B goes down. Once his sights are on B he should keep the triggers of both guns on until something happens. If he attempts to break with B, the chances are that B will get him. The Browning guns and Nelson gears take a lot of beating, and will stand long continuous fire. Some pilots prefer the Aldis sight, others like an open sight best.

If open sights are used a head rest must be provided to keep the pilot's eye in the proper position for the length of the sight bar and to avoid parallax. The open sight gives better general vision, but personally I like the Aldis type best, and I hear that it is being improved to give a larger field, more magnification and proper speed rings, which will help. Each pilot should boresight and synchronize his own guns and calibrate his own ammunition for record practices. In war no pilot would let anyone but himself do these things, and he should therefore do them in peace time. In boresighting, one gun should first be put in line with the axis of flight of the plane, using levels. The other gun should then be brought on with it, and then the sight should be brought on with the two guns.

As the next step let us consider an attack by a single fighter, A, against a 2 seater, B, having a free gun aft. This is comparatively simple. A gets in position ahead of B and above him, turns and dives, attacking B on the bow and from below. If A attacks from above, B can bring his gun to bear over the top wing by diving. In any event B will endeavor to turn to bring his gun to bear outside of his wing tips. A should, however, be able to close fast enough to get out a good long burst before the free gun sights can come on him clear of their own structure. A fighter should not buck a free gun, but it must be remembered that present free guns are hard to handle, and if trained on one side, a fighter can close on the other side before the free gun can be brought around on to him. If A attacks from the rear, B can bring his free gun to bear with a slight kick of the rudder.

When a 2 seater has a free gun forward and one aft, it is a tough proposition for any fighter. The best method of attack seems to be by diving full gun past his tail, taking the chance of snap shots at extreme range from his after gun, then pulling up almost vertically underneath him. The burst obtained in this method is short, and fighters shoot best on the level or in shallow zooms or dives, next best in steep dives, and poorest in steep (vertical) zooms. If the fighter carries sufficient speed, he can swerve to miss the two seater, and pull out above him; otherwise he should dive steeply after his attack to get clear.

The simplest phase of formation fighting is when a 3 plane section of fighters encounters a single plane of



If "B" pulls up and around for a burst at "A," "A" can immediately return to his original position above and behind "B."

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Dear Sir:

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This plane you will remember made its maiden flight with Colonel Charles A. Lindbergh as pilot. Since that time in addition to special cross country trips this plane has had 370 hours in the air, and covered approximately 34,600 miles. The total motor time according to our log is 410 hours. In this period of operation we have not had a single forced landing, have maintained our schedules at 100% efficiency, and outside of periodical inspection and check have done nothing whatsoever to the motor except to make one change of spark plugs.

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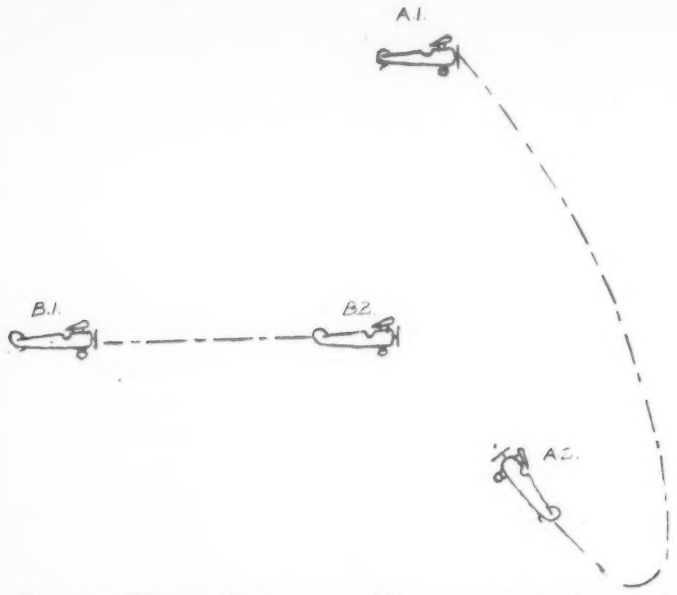


Single seater "A" attacks two-seater, "B."

another type. To attack a single fighter, the 3 planes of a section should act as follows: Number 1 dives on the enemy fighter and closes with him; number 2 opens out to the left, number 3 to the right; both number 2 and number 3 fire at the enemy, keeping on their respective original flanks, using deflection, and breaking off their dives before they are close enough to interfere with number 1. Number 2 and number 3 should never go below the enemy and should attack in dives; the onus of avoiding number 1 rests strictly on them, and they should use deflection fire only. If a single enemy fighter dives upon, let us say, number 3 of a 3 plane section, number 3 proceeds exactly as if he were alone. Number 1 climbs to the right, number 2 climbs to the left. Number 2 and number 3 close in, using deflection fire, but keeping clear of number 1, who carries on the dog-fight.

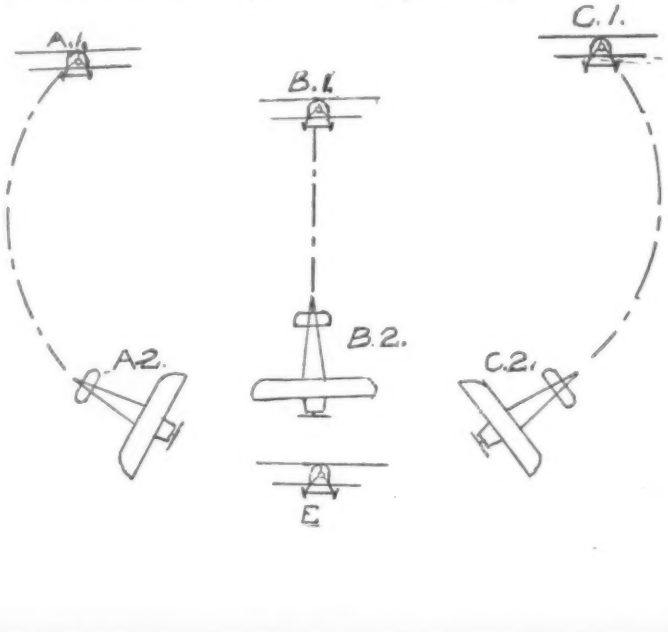
A 3 plane section of fighters attacking a single 2 seater should proceed as follows: The section should pass over and well above the enemy; they separate, number 1 taking the tail sector, number 2 the left bow sector, number 3 the right bow sector. They dive to attack almost together, those 2 planes on which enemy free guns are trained should slow their approach and turn away at extreme range, leaving the third plane to close in unopposed.

Now we come to the question of larger formations, running from a 3 plane section of fighters against a similar 3 plane section up to those vivid formations of the imagination involving tremendous numbers of aircraft. In what has gone before the basic fundamentals of fighting have been brought out. They apply regardless of the numbers of planes concerned. It must not be forgotten that more than one fighter cannot occupy the same position at the same instant. Against large enemy formations, fighters can attack various parts of it simultaneously; against smaller formations they cannot. In attacking formations of 2 or 3 seaters, the cross fire from adjacent planes must be considered. In general, if our leader attacks a plane in an enemy formation, that plane must turn from the formation in order to best protect itself. This gives our second plane a chance to pick his target. In this manner, considering fighters against fighters, a series of dog fights will develop. That side having the largest number of planes will have a tremendous advantage, as excess planes can use deflection fire unopposed. Therefore, when our leader dives to attack, other planes should follow him down as soon as they can pick their targets, and not before.

In attacking large formations of 2 or 3 seaters, fighters should proceed as against a single plane, each fighting section acting as did a single fighter. Here, however, the enemy will maintain formation, and no sectors will be free from free gun fire. In general, each section should act as it did against a single plane, endeavoring to draw fire by feinting, while a single fighter slips in unopposed, probably by a steep zoom from below. Once one or more 2 seaters have been shot down, the formation will become more or less broken, and the task of the fighters rendered much easier.

It is certain that much more experience in the air is required before any very definite fighting rules for large formations of aircraft can be laid down, and it is doubtful that such rules can ever be strictly adhered to. Each situation will de-

Simple formation attack of three planes section against single enemy.



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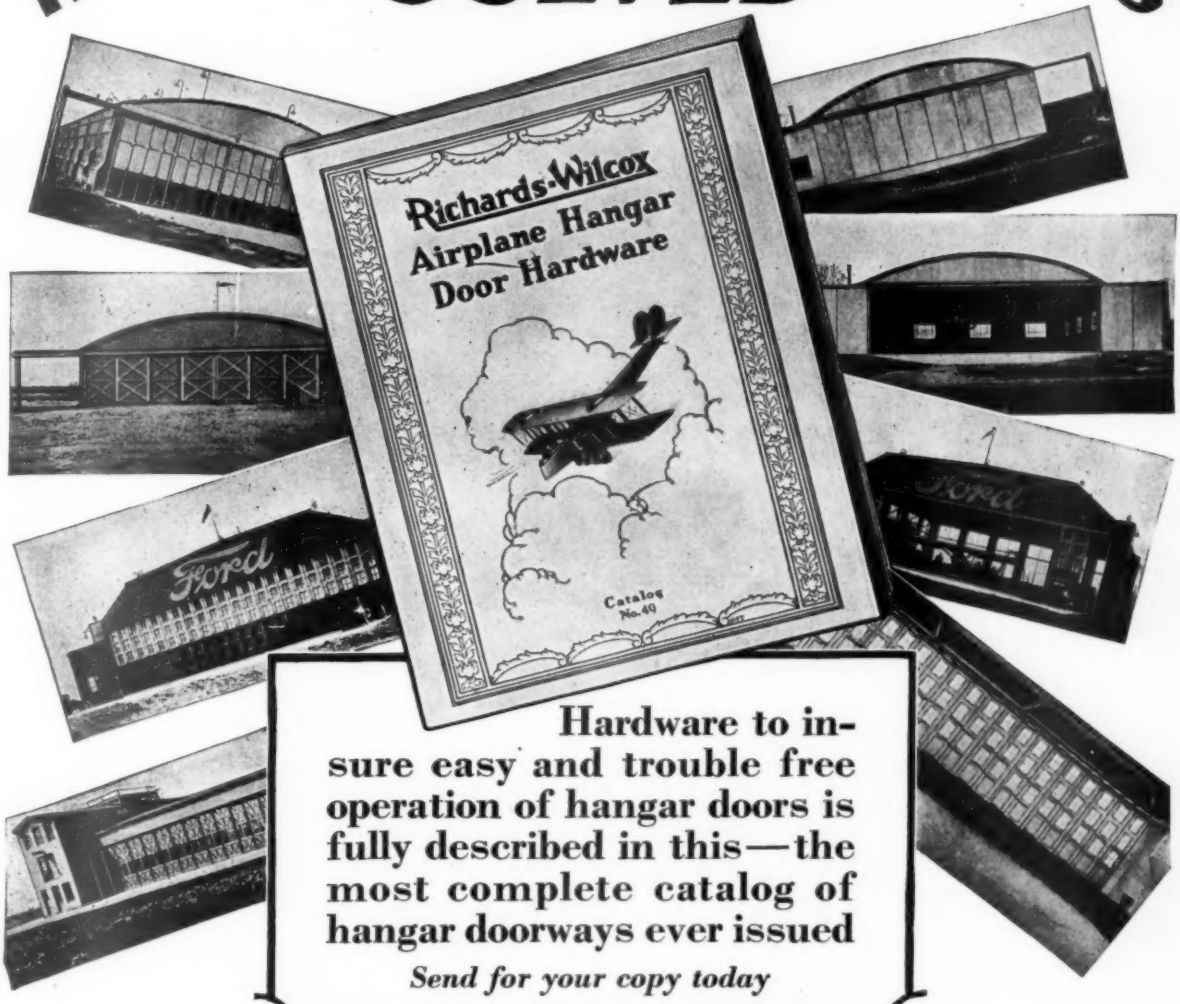

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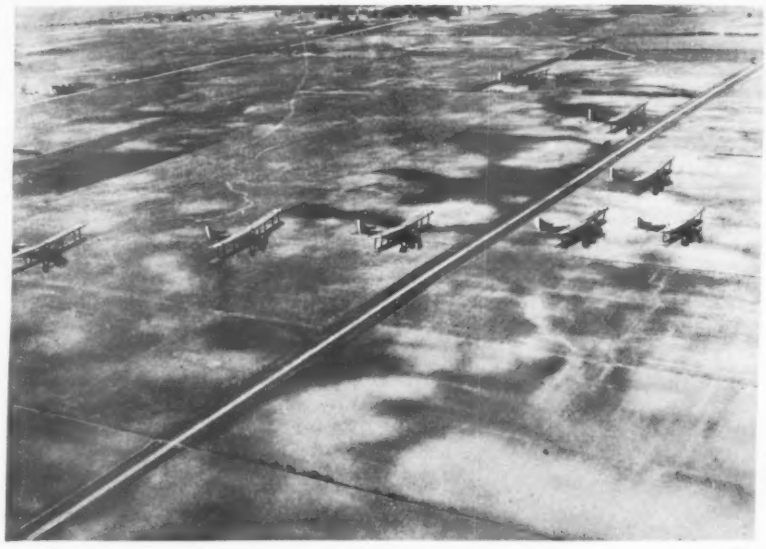
velop so rapidly in its various stages that, as always, the deciding factor will be the skill and initiative of the fighting pilots, and their intuitive co-operation gained only by much experience in working together.

After all, that is the purpose of the constant work we go through—to accustom ourselves to working together to such an intimate degree that the maneuvers become second nature to us. With practice we can reach a point where each man is fully confident, not of his own, but of his comrades' ability in any situation.

Hope that your new outfit gets along fine, and that this long-winded spiel satisfies your craving for information.

Sincerely, Jack.



"Forced Landings"

THE response to the first call for stories of Forced Landings was so productive of good material that POPULAR AVIATION has decided to continue to offer a prize each month for the best forced landing story sent in. This time there are no restrictions. Each story will be judged upon its merits, not as a specimen of composition but as a story involving a forced landing.

There are so many excellent stories going the rounds verbally that POPULAR AVIATION believes that an effort should be made to preserve them. This type of anecdote becomes all too rare as time goes on. Had it not been for Mark Twain, many of the anecdotes of the Mississippi river men would have been forgotten a generation ago.

We do not like to think that in a few years no one will be telling the story of the Texas steer and the Very light pistol, the ice island in the Mississippi, and many others that space prevents mentioning. Many of those who have had such experiences hesitate to "break into print" with them, so we now invite any one who cares to send in these stories. We know there is a wealth of untouched material.

The narrative need not be funny, nor the circumstances especially unusual. Almost anyone knows what makes a good story. If it is one that bears retelling in the hotel lobby, around the field or in the hangar, it is probably a pretty fair tale, and so has a chance for a prize.

Readers need not confine themselves to present day happenings or to those of the very early days of flying. The life of almost any flyer is replete with experiences that should be shared with the public.

We will continue to give a hundred dollar wrist watch for the best Forced Landing story received each month. This particular offer applies to all those received between this date and September 30th. For our convenience please write on one side of the page only. If you desire the return of your story enclose a stamped and addressed envelope. Pictures help make a story.

Every month POPULAR AVIATION will award some such prize. As time goes on it may be desirable to offer prizes in cash or some other article, or to change the subject matter for which the prize is awarded. But our readers can look forward to this as a regular feature. The conditions will be announced each month and ample time will be given the readers in which to prepare and mail their offerings.

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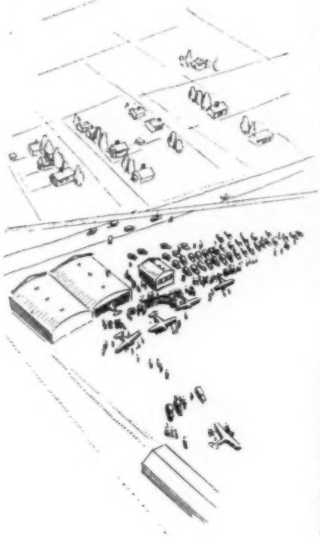

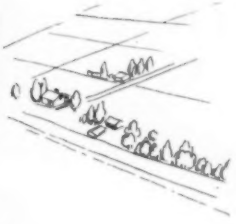

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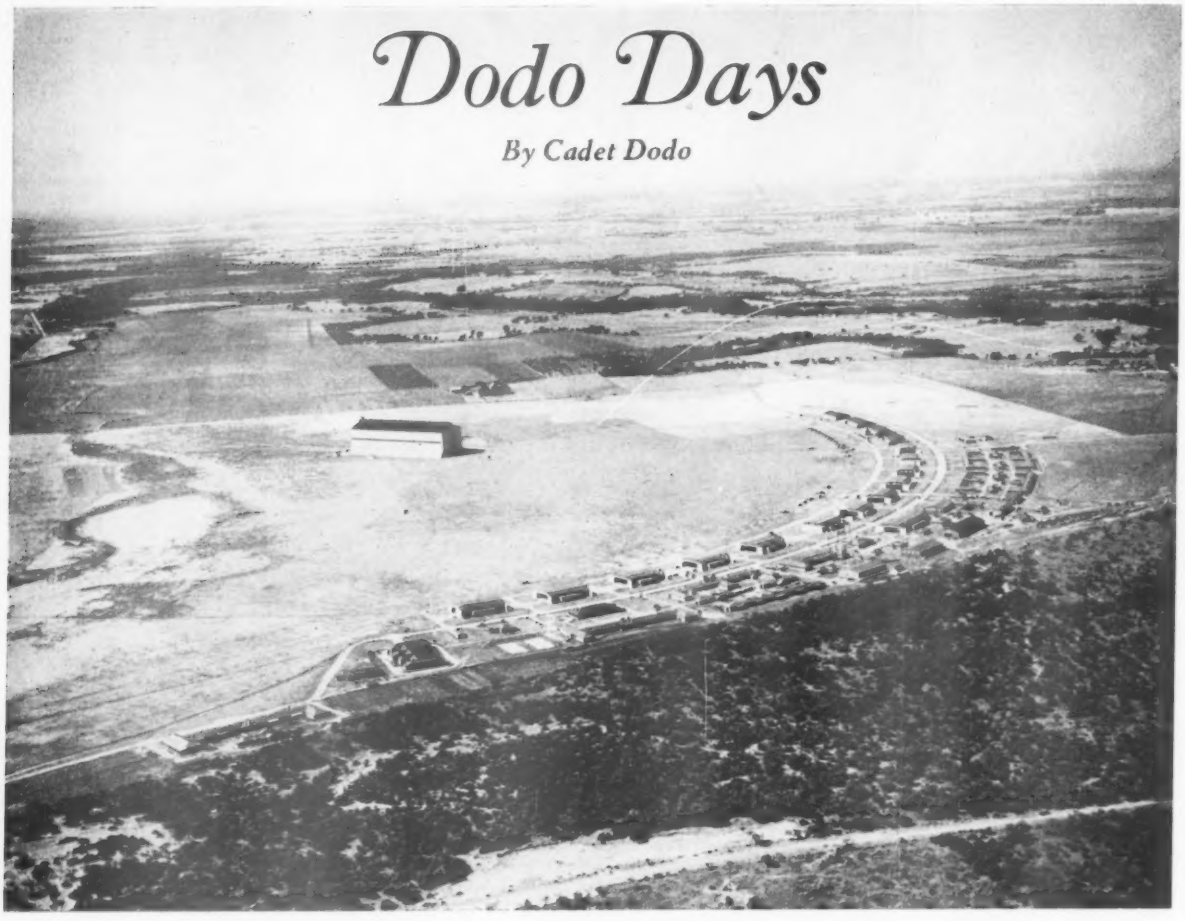
Dodo Days

By Cadet Dodo



Cadet Life at Brooks Field

Another one of the series dealing with the routine and experience of the men who learn to fly for the Army.

DING! Ding! Ding!

"What?—Reveille, at this time? It seems as though we have just gone to bed" said a sleepy Cadet, as he rolled over, rubbed his blurry eyes, and looked at his wrist watch, to assure himself that he wasn't dreaming.

"Five minutes to six," he announced.

There was no need for this information, however, as three-fourths of the Cadets were already out of bed, and rushing to get dressed in time for the outside formation, and those who had been peacefully sleeping one minute before pulled on their clothes and waited for the second bell. There was no need for a lengthy wait for, in a very short time, the bell rang and the company formed outside. Many who had attempted to sleep just a minute more found it necessary to finish dressing on the way out and while in the ranks.

"Fall in!"
"Right dress!"
"Front!"
"Count off!"
"Sick report!"
"Fall out!"
"Count off!"
"Squads right! March!"
"Double quick time—March!"

The company broke in a double quick time run which was kept up for fifteen or twenty more minutes. More than one hundred tired Dodos jogged wearily along with the command—"To the rear—march!" Most of the boys could keep up for the first five or ten minutes, but thereafter the squads became uneven, some falling back and others moving up to take their place. The small but grim cadet-sergeant would loosen up for a moment and would give the order: "Quick time—March!" but after thirty seconds we were again on the trot.

This was the regular daily morning routine and was dreaded by the whole company. This was done ostensibly to keep us in shape but many suspected that it was done primarily to make us realize that we were Dodos and were to become accustomed to doing some things that were slightly disagreeable to us.

"Company dismissed!"

The panting group rushed to the

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barracks for a chance to wash before breakfast. Occasionally one could have a minute or two to start making his bed, but more frequently one would be lucky to have the extra minute to wash.

At the breakfast formation we were told that special formations would be held for the various examinations and other tests. This always causes considerable comment among the cadets who have not any part of this ordeal.

The student barracks at Brooks Field from the air.

After breakfast the boys did a double-quick time from the mess hall to the barracks for two reasons, one was because it was one of the cadet orders and the other because they were in quite a hurry to make their beds and clean up around their bunks. Cadets are taught and required to make up their beds in a way that would make the best housekeeper blush with shame. It is surprising what one can do if he has to.

After completing this task each Dodo would wait in a most painstaking manner for his turn on the two or three brooms which were supposed to suffice as many as twenty-five cadets.

"Next on the broom, Hayes" yelled Clemens.

"Can't. Promised it to Anderson," replied the portly Hayes.

"Say! Who is the boy orderly? Clean up this dirt in the aisle and fill the fire buckets."

"And, say! Don't forget to line up the beds and foot lockers," advised another.

The place looked as clean as a hospital operating room before an operation, for the daily morning inspection would see to it that anyone who had failed to have his bunk in perfect shape would get plenty of demerits.

"The bells again. Another formation!" shouted several in unison.

"Special formation for the '609' and the orientator!" shouted the master Dodo as he strode down the hall. "All out!"

Again the usual commands and we were in formation awaiting with interest and not a little fear as the master Dodo marched up with a handful of papers.

"At ease!"

"As your name is called answer, 'Here Sir!'"

"Fall out double time, salute, and get your paper, then fall in on my right!" were the brief but exact orders that he gave.

Two details were formed, one was marched to the surgeon's office in the aviation school of medicine and the other to the famous "Hangar" which was the home of the "orientator" and the headquarters of the "officer in charge of flying."

After arriving there we were put through the various tests in order. The first was the eye test, the worst part of the "609." Two young surgeons were busily engaged in a room giving the various exacting eye tests. One was to read the various charts with the naked eye. Another test, but far more difficult, was moving a line over a light, using a complicated set of lenses. This was quite a task and frequently proved a nightmare to the prospective candidates. After a seemingly interminable length of time, one would have the line exactly over the light (which was held at a distance by the examining surgeon) he would suddenly notice or think he noticed a slight variation and would accordingly attempt to correct for it. As a matter of fact, it was really right in the first place and the variation was caused by the inability of the eye to keep in focus for longer than a few seconds. After each trial the flight surgeon would make his notation and would anxiously follow him every moment in the hope that he might betray something unsatisfactory. The aparatus used in this test was so complicated that I often wondered, just how he checked up on us, but I never for an instant doubted his ability to do so.

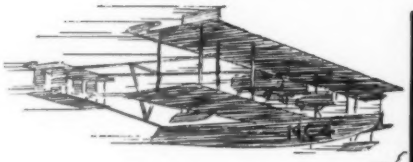
Our depth perception was tested by means of a very simple apparatus which consisted of a box platform at a distance of about 20 or more feet from the person examined. This box was open in the front and inside of it were two upright sticks one of which could be moved by the pulling of a double cord extending out to the subject of examination. One was required to get the sticks as closely together as possible by pulling the cord in either direction. This was repeated several times and the degree of accuracy was noted by the examiner.

Muscle balance was tested by means of the very simple apparatus of a ruler and a pin with a white head. The pin was moved in towards the eye to a point where it could no longer be seen, in other words, to the point where the eyes were unable to focus. This was repeated in the reverse direction, the surgeon peering sharply into one's eye during the entire operation.

After finishing all these a large chart of colors was placed in front of the subject (of the ordeal) and he was asked to identify all the dark, light and various other factors about the colors.

The last of the eye tests, as I remember them, consisted of reading

Nine Years Ago this Man Piloted the First Plane Across the Atlantic



The NC-4—first plane to cross the Atlantic, piloted by Lieut. Walter Hinton. Left Trepassey Bay, Newfoundland, and arrived Lisbon, Portugal, May, 1919.

Walter Hinton

was pilot of the NC-4, *first* plane to successfully cross the Atlantic. He was the *first* man to fly from North to South America. He is the *first and only* world-famous flyer to give home-study students the benefit of his experience. During the War he was a crack flying instructor for the Navy. He knows how to *teach* men the *practical* way. He gives you your foundation for real success and a real future in Aviation. Get his Free Book — TODAY.

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various numbers on each page of a book of twenty or more pages. Each page had a number in one color on a background of another color (both colors being on perforated paper). The pages became successively more difficult as the colors became more nearly alike. This being finished, the eye test was concluded, unless in the opinion of the flight surgeon, refraction was necessary due to a poor showing in one or more of the other tests. In refracting, the eye was dilated for the purpose of determining whether the eye conditions were normal. This examination omitted one of those used in the preliminary —at Mitchel Field, New York—but nevertheless was exceedingly thorough in all details.

In comparison to the eye, the nose, ear and throat examinations seemed casual but it was probably because there are not so many ways to test these last mentioned organs.

This being "over with" the physical examination was next in order for each individual. The order depended upon those finishing the various tests. Six different rooms were used, and outside of each there was a group of cadets awaiting disposal. Many interesting conversations were in order among those awaiting their turns for the succeeding tests.

"Did you have your eye test yet?" asked one.

"Yes," replied another, "mine are O. K., how are yours?"

"Have to come back for refraction but have finished every other test except the personality," answered the first.

"Say, I've heard that five were washed out yesterday on the eye test."

"Is that really true," asked another.

"Yes, I've heard several others say the same thing, so I guess it's a fact" replied a worried looking cadet who did not think he was doing so well.

The famous reaction time test was the next one on the list for me. After being ushered into the room by one of the operators I was shown the instrument used in determining the time necessary for one of register reaction.

"Sit down and look into the shield, and tell me what you see" said a kindly young fellow who was about to put me through the test.

"Now, you see a green light, do you not? And now a red light. This is the buzzer." With that he pressed a button and a shrill sound was emitted.

"When the green light flashes, press the right hand key; for the red light press the left hand key; and for the buzzer use the right hand key. The results will automatically show on a paper and remember speed and accuracy count. All right, we'll practice for a while. I will use one thing at a time. First the green light will appear and you will press the right hand key instantly."

Keeping my hand on the key tensely, I waited for the light. When I saw it, I clamped my finger violently on the key, again, again. . .

"Faster" he exhorted, "that's it, buddie, keep it up."

The process were repeated for the red light, using the left hand key, and for the buzzer using the right hand key.

"Now, the lights will appear in mixed order together with the buzzer sound. Press the proper key after each flash and sound and if a mistake is made the light will still appear or the sound continue, until the correction is made. Remember, speed and accuracy count."

By this time, I fully appreciated the fact and prepared to do my worst, while trying to do my best. One would become unusually tense and nervous as all understood that failures in any two of the special tests, or any part of the physical examination would mean disqualification.

"All set?"

"Yes, sir."

"Contact," and we were off—and so was I.

A red light appeared and after a slight, but too long hesitation, I pressed the key with my left hand.

"Faster" he warned.

I made sure that he wasn't going

The Orientator—and doesn't it look like a baby carriage?

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to get me this time. A green light and I immediately pressed the right key.

"Good," he exclaimed, "keep up the good work."

Another green light. The next one will probably be a red, I figured, but a buzzing sound told me I had figured badly and I had to correct by pressing the right after I had shoved the left key on what would have been a good hit as far as the time was concerned. The indicator was showing long lines, however, and I heard: "Keep those lines short, and remember that speed and accuracy count." I did remember, and it surely required concentration of the highest order to be able to translate both visual and auditory impressions into the proper reactions. We continued and I was rather dubious and despaired of ever passing the test.

"All right, we'll try it again" he said, tearing up the record, "and remember that speed and accuracy count."

I did remember, but was quite relieved to know that I was to have another chance. This time, I did somewhat better and as I realized later, one improves with practice and as a matter of fact, constant practice is all that is necessary for any of these tests.

After finishing with this test, I was prepared for some more fun as I awaited my turn on the instrument of torture, called and properly so called, the complex-coordinator. This apparatus was built on the same order as a plane. In front of the "pilot's" seat there was an instrument board with an indescribably complicated system of lights which were jointly controlled by the operator, back of the board and the subject in the seat who used a rudder bar and "joy" stick. There were two double rows of lights, the top of each operated by the lady in front and the lower by the "would be" pilot.

"Listen carefully, and do as I tell you," she said, "and remember that speed and accuracy count. Also, notice that by moving your rudder bar you operate the lower lights in the upper row, and the stick controls the lower lights in the bottom row. Now, I will flash two lights together in the top line of both rows and you operate both controls so that each of your lights is directly under the right hand light of the ones that I operate. Immediately after move back to neutral. The large light on the top of the board will change to yellow from red as soon as you have correctly completed each attempt. And (again) remember, speed and accuracy count."

"Now, if you're all set, we'll have a few practice trials."

Compared to this test the "reaction time test" was simple. A few attempts soon convinced me of the extreme concentration and coordination that was necessary in order to secure a good score in this test.

Easy—when it's right side up and you can go slow.

"Now, get ready for the real test" she informed me and the result made me more tense than ever. If some one had exploded a small firecracker, I would have been shell-shocked.

We were "off again" and I found it necessary to do all sorts of tail spins, nose dives, loops, and rolls to follow her mad dash of lights and to move both controls simultaneously to achieve speed.

"Now, the direction of the controls will be reversed," she told me and we did the same manouvers, but using opposite controls. Just as if that were not enough, she had me place the lights under the left hand of each group. Then, not at all satisfied, the nice little lady crossed controls and seemed to try harder than ever to mix me up and slow up my speed of reaction.

These tests had consumed an entire day and I never want to put in another day like it again if I can help it.

In the barracks that night there ensued one of the most interesting bull sessions that it was ever my good fortune to witness. Talk such as this was prevalent.

"What did you do in the reaction time test?"

"Say, fellow, but wasn't that complex coordinator, complex?"

"Must you have your eyes refracted?"

"Just wait until you take the personality test, it takes three hours to have him ask the questions and write down the answers."

"No fooling!"

"No, Sir! That's a fact. I was with the Flight Surgeon from 9 a. m. to 12:30 and he had to rush to get me through. There are a dozen pages of questions and some of you fellows had better be careful as some of them are rather personal. You can't fool them."

"Say, what is the idea of all these tests? Are they going to wash us out on these tests?"

Nobody seemed to know, but many were the rumors as to their purpose and what would happen to those failing to pass them all. Some advanced the theory that the War Department was trying to get data on just what type makes the best flyer and then they can exercise a more careful selection for the future cadets. That, by the way, is the whole attitude of the school, in putting the entire question back on those to be trained rather than those doing the training. If a person can get through the school, he is the type that has "inherent natural flying ability," but if he fails to get through then he is not the type. Of course, there is no doubt that some can fly better and learn quicker than others, but the personal element cannot be said to be unilateral.

Another day dawns, the usual routine and formations and more of us were again marched up to resume the tests where they were left off. This time, I am able to get first in

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February	Four Planes Weekly
March	Five Planes Weekly
April	Nine Planes Weekly
May	Twelve Planes Weekly
June	Twenty Planes Weekly
July (Estimated)	Twenty-five Planes Weekly

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line for the neuro-psychiatric, commonly known as the personality test. This was worse than any senate investigation. The following are a few of the numerous questions asked during three hours of grilling.

"Name? Age? What different schools? Do you learn quickly? What line interests you the most? Are you quick to anger? Do you lead or follow? What activities were you in? Do you show your reactions easily? Are you emotional? Are you affectionate? What is your standard of morals? What type of girl appeals to you? Do you like to read? What kind of books?"

Following this was a detailed list of questions on one's history, the entire family history and other questions, more than any one man could think up in a life time. I bore up rather well, however, since my inquisitor was rather human about it all, and admitted to me that he, himself, didn't think much of the whole set of questions.

That same day, I finished the physical examination, which although quite thorough, was easier to go through in comparison to many of the others. After having my pulse taken and my blood pressure determined and after standing on one leg, sticking out my tongue, and all that, I was also "tested" except for the famous Orientator—"the flying bath tub."

"All out for the Orientator formation," shouted the master Dodo as he ran through the bays the next morning.

This was the climax of all tests the best and most enjoyable of all those designed to find out everything about the prospective flyer.

After being strapped in the Orientator, the instructor, who was the one who operated the mechanism from the outside, explained the workings of this intricate ground flying monster.

"You will notice that this Orientator has the same type of controls as are found in an ordinary airplane. Now operate the rudder bar and notice how the nose of the Orientator turns from side to side. Then take the stick and notice how it tilts the ship in proportion to the width of the arc described. By pulling back or pushing forward on the stick you will see that the nose moves back or is pushed down which is similar to climbing and diving in a plane. Now bank the ship over beyond 45° and notice the changed function of both the rudder and the elevator.

He had us practicing on simple twist and tilts using one control at a time and gradually had us using both the rudder and the stick simultaneously, for a general bank to both the right and left.

"Now do a vertical bank first to the right and then to the left and notice that your elevator becomes

But—upside down, with controls reversed — that's something else.

your rudder and as you press on the rudder you will only be moving your nose up and down. There, that's fairly good. Now do a vertical bank leading off with the rudder."

This last operation certainly was a real one and practically every person kept his rudder on too long, that is, past 45° and consequently tied himself in a knot and quite often the instructor had to right the carriage with the outside controls. After practising on this a while, we were shown how to do loops, the last one being done with closed eyes, the subject stopping when he thought the carriage was level.

This was the first of three rides, and of course, it was designed primarily to teach the subject the workings of the controls. The second time, we were told what to do and had to do it by ourselves, and the third time we not only had to perform but had to correct for the instructor's attempts to throw us out. This was extremely difficult and quite often the subject was hopelessly "balled up." The loop was an especially delicate operation when you found that in spite of your efforts and constant vigil, something always seemed to go wrong.

After completing the manouvers heretofore mentioned, we were required to keep the nose in line with some distant spot while the instructor moved it sharply in all conceivable positions.

During all these three trials, two other officers beside the instructor kept close note of one's grade and progress. They graded on expression, coordination, reaction, personality, fear, etc. It certainly was quite interesting to note the expression on the faces of some of the candidates. It would seem that some feared riding this perfectly harmless though unruly toy more than to go through the most terrible of aerobatics. Much more could be said concerning "the flying bath tub" and of the experiences of some of the Dodos in this peculiar though almost natural monster.

The days passed by until practically all of the examinations and tests had been administered and we were being groomed for ground school and flying.

(The next installment of this series will tell of the ground school and flying days for the U. S. Army Cadets.)

Largest All-Metal Monoplane

The world's largest all-metal monoplane was recently tested at Marlesham Heath, England, in a series of tests showing the plane to be a success. Squadron Leader J. Noakes flew the plane for fifteen minutes and attained an altitude of 2,000 feet. This huge machine weighs 15 tons, has a wing spread of 150 feet, and is propelled by three Rolls-Royce "Condor" engines, each developing 650 horse power. The tires and landing wheels stand 7 feet, 6 inches high, not much smaller than a small sport plane.

U. S. Department of Commerce Approved Type Certificate No. 29

SPECIFICATIONS

Span, upper wing	31 ft. 2 in.
Span, lower wing	34 ft. 1 in.
Chord, top and bottom	5 ft.
Aspect ratio	6.20 ft.
Stagger	15 in.
Sweep Back	None
Dihedral, lower wing	2½ dg.
Dihedral, upper wing	None
Wing Area	310 sq. ft.
Airfoil Section	Clark Y
Height, overall	9 ft.
Length, overall	25 ft. 5 in.
Weight, empty	1340 lbs.
Wing Loading	6.80 per sq. ft.
Speed, maximum	99 mph.
Speed, cruising	85 mph.
Speed, minimum	35 mph.
Useful Load	775 lbs.
Fuel Capacity	35 gal.
Radius, maximum speed	396 miles
Climb, initial	600 ft. per min.
Ceiling	15,000

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These are but a few of the many improvements, but enough to show that we are keeping a promise to deliver finer airplanes (in their class) for the price asked.

Book Section

LIKE the postman who spends his holidays taking long walks, editors seem to enjoy using their spare time in reading. At any rate, all of them would if they could pick up books as entertaining and informing as those that fell to my lot this past month. I will admit a bias right at the start, but how anyone could fail to be entertained by Knights of the Wing, written by A. M. Jacobs and published by Century, I cannot see. I almost said entertained and instructed, but the last is a phrase that will make many shy away from a book that is not definitely a text book.

Still, Miss Jacobs, who is one of the little known experts in matters aeronautical through her connection with the staff at Wright Field, has somehow managed to combine her intimate knowledge of the subject and a delightful style to read with a result that is more than pleasing. The book deals with parachutes, radio beacons, altitude flights, night flying, seaplanes, photography, testing, data flights, cross country, and a brief recounting of some of last summer's great flights. There are anecdotes interspersed with bits of history, explanations of some matters that puzzle the layman, and deftly concealed statistics. I wished it had been a hundred pages longer.

From that I turned with a sort of sigh to a book on international law, with the expectation of wading through a mass of uninteresting discussions and cases covering the application of international law and the laws of war to aircraft. I know that every reader will be just as surprised and gratified as I was to find it a fascinating book. I refer to J. M. Spaight's Air Power and War Rights (Longman's, $10.00). Crammed with cases illustrating every conceivable point of law and war rights as applied to the operation of aircraft, it will be found a mine of information to others beside the student of the laws of war. If you want to know the actual facts of the first aerial combat here you have them. Here are cases of forced landings in enemy country, stories of escapes, and between the formal reports and bare mention of these happenings you can read a world of adventure.

Of course, all that is aside from the purpose and the true value of the book as the finest, and possibly the only complete presentation of the subject. Mr. Spaight in his chapters on bombing brings out some of the possibilities of aircraft in future wars and shows the necessity for the holding of a convention to set up further rules for the waging of war by aircraft. One reads these chapters with a pause, and a silent hope that this great new instrument of war may yet prove to be the greatest single instrument of peace.

Needless to say, here was a book that was not finished at one sitting. It is going to repose on the desk within easy reach to act as arbiter in a lot of arguments.

With the memory of much front page stuff and a lot of bitter arguments I turned again to Col. Mitchell's "Winged Defense" (Putnam), and re-read it with a good deal of interest. You know, it doesn't matter which side of the argument you take, you may be for or against unified control of the air service, but you do have to admit that he brings out some powerful arguments for the necessity of a strong air force. He is quoted abroad, and only lately I have seen a book by a British Rear-Admiral which takes the bombing of the Ostfriesland and the New Jersey, and builds up a powerful case on the same data as the Colonel. It really wouldn't hurt anyone, no matter what his views, to read Winged Defense. It is the sort of book to make one see the possibilities of aircraft are not yet fully realized.

Considering the volume of letters that have been coming in relating to books and reading courses on aviation it does not seem necessary for us to extend an invitation to our readers to present their problems to us. But we are glad to tell those who may have some hesitancy in writing us, that we will be glad to answer any letters that seek information about books, whether to be used as texts for serious study, for inspirational reading, or as data for papers, or for just passing the time. The complete list of the Popular Aviation Library will be found on later pages of this number.

The last mail brought in a copy of "Air Men or Noahs?" by Rear Admiral Sueter of the Royal Navy (Pitman). Intrigued by the title I made time enough to glance through it and then determined that I would pack it along on a week end trip and go through it carefully. With only this casual glance I know our readers will enjoy this work. It reminds me of Admiral Mark Kerr's book, "Land, Sea and Air," not simply because both were written by British sea dogs, but because of the anecdotal character of both books, and because here are two navy men who are "sold" on aviation.

Books Received

Beginning to Fly—Hamburg .....**(Houghton-Mifflin, $2.50)**

Airmen or Noahs—Sueter.....
.....**(Pitman, $7.50)**

Knights of the Wing—Jacobs
.....**(Century, $2.00)**

The Principles of Aerography —McAdie .....
.....**(Rand-McNally, $3.00)**

Bill Bruce and the Pioneer Aviators—Arnold .....
.....**(Burt, $0.75)**

Conquering the Air (Revised) —Williams ..**(Nelson, $2.00)**

The Strategy and Tactics of Air Fighting—Stewart.....
.....**(Longmans, $2.50)**

Airplane Structures—Pippard Pritchard .....
..... **(Longmans, $6.00)**

Australia and Back—Cobham
..... **(Macmillan, $1.50)**

My Flight to the Cape—Cobham .....**(Macmillan, $1.50)**

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College Aero Club News

THE tremendous progress in aeronautics in the past year has aroused intense interest and has caused extensive activities on all sides of us. An evidence of this activity can readily be seen in our colleges and universities which, because of their inherent advantages of possessing facilities and equipment and their worth in furthering higher education, have already done so much to educate the college man in the aeronautical field.

A few of the larger universities have had aeronautical clubs and various courses in aeronautics, but in the past year dozens of successful clubs have been formed and literally hundreds of courses installed in many of the higher institutions of learning. This is but a beginning and only serves to indicate the unlimited possibilities of college influence in all types of education — whether technical, commercial or actual flying is considered.

Colleges and universities will be, as in the past, the training ground for leaders in aeronautics. A thorough training in the fundamentals of this great and growing field, plus a background of general college training will contribute men with a specialized training in all phases of aeronautics and will also make possible a greater understanding of the problems in this great field.

It will be the purpose of this section of *Popular Aviation* to assist this movement in every way, to render any assistance possible, and to offer encouragement for this work, in the belief that a closer co-operation and higher degree of understanding will follow.

Loening Race Postponed

The contest committee of the National Aeronautical Association has announced that the contest for the Loening Trophy, which was originally scheduled for June 16, has been postponed until September 1st. The committee feels that by allowing the various clubs to use the summer months for additional preparations, and by permitting the pilots to accumulate more time in the air, there will be more teams representing the colleges and a more successful contest will be held.

Yale Sponsors Conference

The president of the Yale Aeronautical Society, N. L. Engelhardt, is planning to foster the holding of a conference of representatives of College Aero Clubs and University authorities at New Haven, early next fall.

This conference would discuss the questions of Air Races, formation of Aero Clubs, operation of clubs, other forms of collegiate competition and the possibility of research to be conducted by college clubs. There is no doubt that such a conference is needed and can do much toward the clarification of certain present problems by arriving at some common basis of procedure and operation. It is a case of united we stand, and divided we stand still.

Popular Aviation strongly approves of the enterprise of the Yale Society president and hopes that the conference will be well attended and prove successful.

University of Oklahoma

The University of Oklahoma has issued a somewhat different plan of organization for the promotion of aeronautical activitives. In preference to the usual method of college club organization they have formed what is probably the first professional aviation fraternity among college men. With the purpose of stimulating interest, education, and of actually learning to fly, several students organized Tau Omega. In order to gain admission to this fraternity a real interest had to be manifested and talks had to be given by its pledges in order to determine their fitness and eligibility to the group.

Hazlipp and the "Miss O. U."

"Jimmy" Hazlipp, a former war pilot of considerable experience, and also the one who owns the planes used in flying instruction, was elected the first president. Their idea is to keep the fraternity wholly an educational society and anyone interested in aeronautics is invited to attend the meetings. Those who show more than ordinary interest, and whose

GRASP The THEORY and PRINCIPLES of FLYING

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CHAPTER EIGHT
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CHAPTER NINE
Pilot Licenses—The First Lesson
How to Become a Pilot—Inspection—Taxiing—Taking-off—Climbing—Flying Level—Turns and Banks—Landing.

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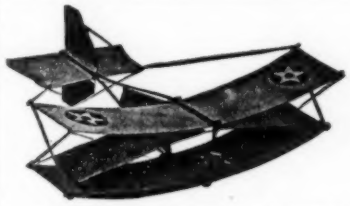

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Handling Motorless Planes

By John H. D. Blanke

IN the year 1883 Rayleigh stated that the motionless flight or glide of the bird is possible only when the path of flight is not horizontal, or when the air current is not horizontal or when the wind is not uniform. If the path of flight is not horizontal and is inclined downwards, travel in air is effected by gliding. The glider is held slightly downward in front to an extent depending on the relation between wing surface and the weight of the glider. Under less favorable conditions the gliding angle may be one to six and under favorable conditions at least 1:10, so that for a height of 90 ft. to start with the glider would touch ground only after gliding 900 ft., provided the ground is level or horizontal. If there happens to be an air current which is not horizontal, but passes upward at the same angle as that of the glider in gliding downward, the gliding angle and the wind current angle compensate each other and because of this the glider will glide in a practically horizontal direction; this action takes place in gliding above the slopes of dunes, hills and other objects.

The birds, due to their physiological structure, are able to adjust their wing surface area readily to the requirements set up by the changes in the ascending air currents, and therefore they are able to hover practically motionless and in one place, which may be called flying without aerodynamic forward motion, according to Dr. Eng. A. Proell who contributed an article on the Scientific Principles and prospects of Motorless Flying to the *VDI-Zeitschrift* of May 31, 1924. The ideal flying without a motion of wings or other contrivance and without losing altitude, is the sailing flight in which those forces are utilized that are present in the air itself. These forces are brought about by the dissimilarity of the air currents in both horizontal and vertical directions, and by the difference in the strength of the air currents, such as whirls, gusts, air waves and turbulences which are caused by the influence of heat plus the contour or shape of the ground and by other conditions brought about by the sunrays. There are changes in air currents on land, on sea and above smaller bodies of water during the day, which must be considered by the student of gliding. Some of the gusts of wind carry on to an altitude of about 12,000 feet. The dynamic air whirls are caused by obstructions on the ground such as mountain sides, dunes, forest edges, sides of buildings, etc. The difference in the strength of the air currents is a source of power in that it permits by its ascending movement a gain in altitude for the glider, so that gliding may be continued for longer distances. The ocean waves in themselves produce air currents of small length which may be utilized for gliding if the wind is sufficiently strong. Birds are able to vary their wing surface area during the course of flight and are less dependent upon tail action than an airplane. They adapt themselves automatically and habitually to the air conditions; they can sail only in the wind, whereas gliding is possible during quiet air conditions. But a more complicated field in flying is the circling around under wind conditions, namely sail flying.

The wind is practically essential for every sailing flight, whereas gliding may be done in quiet air. The sail flyer must take advantage of the air currents. The control is effected suitably by the wing surfaces themselves, for the tail of the sail plane is as a rule already within the sphere of a different air current than the nose of the wing. The ideal sail plane should not be made to change its position due to the winds, but should transform the force of the wind into speed or for gaining altitude. The sail plane should be so designed that its wings are adjustable as a unit or whole and also each one separately in a compensating manner, so that if one wing is adjusted in one direction, the other wing adjusts itself in the opposite direction; however, a little freedom of play in the control gear is desirable.

Efforts have been made to copy the relation of depth to span of the sail plane wings from the wings of the sailing land and sea birds, which relation fluctuates between 1:10 and 1:15. As the wing depth decreases, the relation to air resistance, fluctuations of the pressure point and movement in the transversal axis become more favorable. The bird wing is arched more or less from the pod joint to the wing tip, and there is a slight zig-zag shape in the plane of the wing, such as has been applied to the design of the sail plane Baden-Baden. Other sail planes have been provided with the simple geometric.

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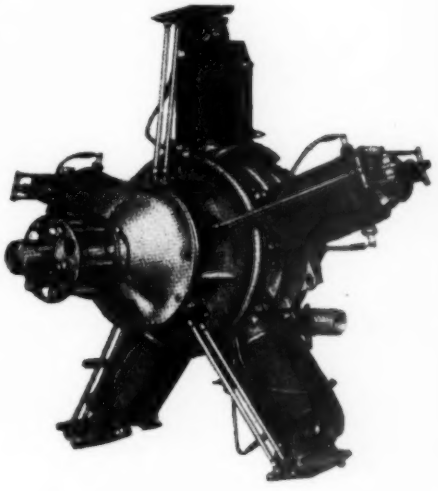

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rectangular or trapeze-shape. The wings of many sail planes run into points. An exact copying of the bird wing would not be suitable.

According to Dr. Eng. R. Eisenlohr in his book, *Der Motorlose Flug* there are three types of gliders, firstly the sail planes; secondly the gliders that are controlled with a rudder; and thirdly, the gliders that are controlled by displacing the weight of the flyer's body. The gliders that are controlled by displacing the body weight may be called in practically every case suspension gliders. They are designed as mono-, bi- and multiplanes. In the method which was used by Lilienthal, the glider operator hangs in the axis of the glider, whereas in the method which was used by Wright, the operator lays flat face down on the glider, so that this glider may be called a reclining glider. In this type no rudder is necessary. In the year 1921 Pelzner could glide only over a distance of 1,312 ft., but after he had installed a side rudder, he could glide as far as 2,460 to 2,625 ft. In the year 1896 Chanute and Herring found that not in every case could the desired control effect be secured by displacing the body; therefore they designed the wings so they could be turned about on the axis and as a result effected good results with this wing-controlled suspension glider.

Those gliders which are flown by aid of a control device, may be called rudder gliders. They are as a rule equipped with altitude, side and transverse rudders, and more or less designed after the customary airplanes. The operators may be able to gain altitude with them under ascending suitably air currents and they could therefore be called gliding sail planes. The sail planes are those gliders in which a special sailing effect is secured and the turbulences in the air are utilized for gaining speed or altitude by aid of special design such as elastic wings, wings of bird-wing design, elimination of tail with controls, etc. This type of glider requires the greatest amount of skill in both design and operation.

The fuselage glider, the type which is provided with a fuselage, is more complicated as compared with the ordinary seat glider, for the weight of the operator has to be supported first by the fuselage and then by the chassis; and then the center of gravity of the glider adds further complications. This type is less suitable as a schooling glider, for it cannot be so easily adapted to the size and weight of different persons as for example the simple glider. In one design of fuselage glider the wings can be raised or lowered from the position in the fuselage by means of a pair of rods running through the fuselage and attached to the rudder stick.

In the year 1920 Friedrich Richter used a seat glider of the biplane type and in 1921 a gliding sail plane of the air plane type. One of the most successful builders of hanging or suspension gliders is W. Pelzner who designed almost exclusively small light biplanes. He used one biplane in the Rhoen contest in the year 1921 which had a span of only 15 feet, an area of 151 sq. ft., and a weight of 21 lb. Other gliders of his type were slightly larger. In the 1921 Rhoen contest he made in one day 6 to 8 flights of a total length of about 3 miles, each flight lasting

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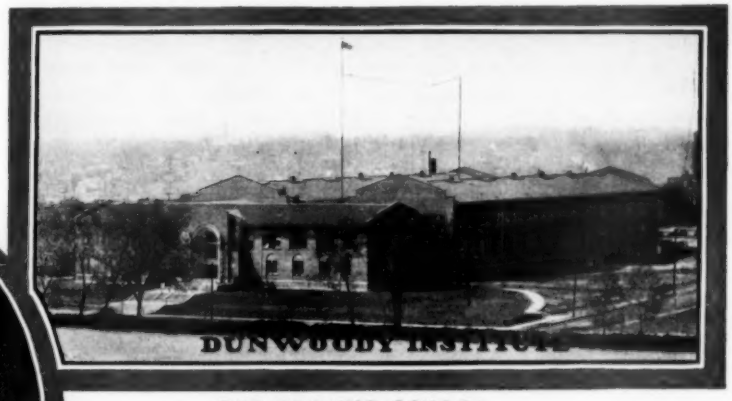

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about 2 minutes; and he had to carry his glider back up the hill, so that it would be very important for this reason alone to have the glider of minimum weight. In the Wright hanging glider the design was such that the operator laid flat face down on the skid, so that transversal control could be effected by moving the body sideways, while the vertical control was effected by manipulating the altitude rudder by hand. In the year 1911 Orville Wright made a glide of 10 minutes duration in which he was able to remain for one minute in one spot by means of a skillful handling of the control.

There are many sail plane gliders having side, altitude and transversal controls; but there are two general groups of sail plane gliders, those with a fuselage, and those with a seat without the fuselage. The first seat glider was built by the Wright Brothers in the year 1901 or 1902. Since the year 1908 E. Offermann has experimented with biplane seat gliders. He employed the Wright design of wing adjustment and could also effect altitude control. A. Lippisch classifies the gliders as hanging gliders, seat gliders, schooling sail planes, performance sail planes and experimental sail planes.

Whereas a ground vehicle such as a motorcycle or bicycle, can travel at any speed within its range, the glider has a minimum speed below which it cannot keep in the air. If carefully designed, the gliding angle of the glider may be lowered or flattened, and in sail planes it may be as low as 1:15 to 1:25. Improvements in glider design have been especially notable during the period of 1921 to 1924, resulting in an astounding mastery by man over the forces of the air without the use of motors or other means of artificial propulsion in the airplane. Static sail flying is being carried out to a high degree of perfection by flying the gliders at the minimum gliding angle to cover the longest possible distance and with the minimum downward movement to cover the maximum of time in the air. Flying with sail planes is being differentiated into two types: the sailing in ascending air currents or static, and the dynamic. In ascending air currents the air rises, thereby exerting a lifting power.

Since the ascending air currents are many, but small, the sail plane should be designed for a minimum falling speed, so that it will be possible to carry on static flying, that is, non-accelerated flying, which permits carrying out endurance records. This kind of static flying in utilizing the ascending air currents, may be observed in birds. No definite direction can be followed by the glider in such a flight.

It is very important for the glider sportsman to know where the ascending currents occur, how strong they are, how they can be recognized and utilized. Thus far it has been found that about the only air currents that can be utilized in gliding are those on the windward side of the mountain where an ascending air current naturally exists. Therefore most of the sail flying has been done above the mountain and dune slopes. The altitude and the horizontal extent of the ascending air currents naturally differs with the territory and with the characteristics and source of the wind. At the Wasserkuppe in Rossitten it was found that the ascending air currents could be

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observed 1,148 ft. above the mountain. Valuable and practical rules have been derived by Dr. Georgii from these air currents for use by the glide flyers. It is known that Martens flew under strong ascending air currents 787 ft. above the ground or at an altitude 4 to 5 times greater than the altitude of the mountain; however, it is likely that thermic effects affected this flight. Thermic currents of air are caused for example at borders of larger bodies of water where during hot sunny days the air heated directly above the ground rises and thus an air flow is established from the water to the land. There are also other ascending warm air currents which suffice to overcome the weight of a well-handled sail plane. Then there are friction air currents at greater altitudes, especially beneath cumulus clouds which are more or less horizontal and may extend for miles. In such a vicinity is an up-flow of air which may be utilized. Then there are local ascending air currents along the coast which are due to the retarded air flow caused by friction of air currents, and congestion.

The problem of the glide and sail flyer is to recognize and utilize these air currents at the proper time. He must develop an air instinct to properly sense these currents. Various devices are used and others are needed to determine the location and strength and direction of air currents before the plane must be controlled to take advantage of them. What may be done in properly sensing the air is shown by the 12 mile flight of Botsch, who with his "Konsul" utilized the ascending air currents of the various mountain slopes to gain sufficient altitude and then simply glided across the socalled dead air spaces to the next mountain slope where he repeated his ascending flight. The most important aspect of sail flying is not static, but dynamic flying. In order to maintain dynamic floating in the air, the wind should prevail for regular intervals and effect periodic fluctuations of sufficient strength. Squalls are of uncertain duration and occurrence, so that considerable heights are likely not to be obtained by utilizing them. Time is always lost during the reaction period which intervenes between the moment the flyer senses the air current and the time he changes his controls. Not only may the strength of the air currents be utilized, but their direction as well. The Albatross and other birds should be studied in respect to their static and dynamic flying.

It has been proven that under normal conditions the wind on a steep slope is sufficient to maintain a glider for hours in the air, but that the conditions change considerably with the thermo-dynamic conditions of the atmosphere. The ascending air above a mountain range reaches about 1/3 the height of the mountain range beyond the mountain peaks. It was found that for example in Germany the upper limit of ascending air currents for different mountains was as shown in Table I on the following page.

As the temperature gradient of the open atmosphere increases, the altitude of influences raises or vice versa. It was found that a wind velocity of about 32.8 ft. per second at the slope created a turbulance and was thus less suitable for gliding. But even with very small temperature differences the vertical velocity

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of the thermic ascending air currents is sufficient for a sail plane flight at an altitude of a few hundred feet. Some direct measurements made of ascending air currents in Germany are shown below in Table No. 2.

In both test cases the thermic ascending air current would suffice at an altitude of 984 to 1,969 ft. to maintain a sail flight. Thus a flight with motorless planes from cloud to cloud would appear rather inviting.

As said before, there are vertical friction movements in the air and these are caused by the descent of air made necessary by ascending air currents. The decrease in friction experienced with air currents when passing above rivers or lakes, results in a descending air current which may be observed at greater altitudes by the dissolution of clouds above lakes and rivers. This opposing friction is especially strong between land and sea. Winds passing from the sea to the land, slow down due to increased friction, so that more wind flows towards the coast than passes into the land; thereby the wind stalls and as a result moves upwards. This effect may be called ascending friction wind or dynamic ascending wind, according to an article in the *Zeitschrift fuer Flugtechnik und Motorluftschiffahrt.*

The experiences are similar to those in mountainous country. There are also differences in temperature in connection with the ascending air. During the war W. Peppler made tests with a kite in Breedene on the coast of Flanders which gave the results in temperature at different altitudes and the corresponding air velocity shown in Table No. 3.

The second and third lines indicate the layer of the friction inversion and of the accelerator in wind velocity. There is a slight increase in temperature at 656 to 1640 ft. altitude and at 1640 ft. in the upper limit of the ascending friction air current. The air velocity changes under the narrowing of the path of the air current, first increasing and then decreasing. Thus the ascending air current on the coast having a level territory, and caused exclusively by the friction between water and land reaches on the average to an altitude of 1640 ft. A kite arrangement or a motored plane as a tow puller may have to be used to bring the sail plane to the altitude at which the air velocity is satisfactory.

There are a thousand and one things that a glide and sail flyer will have to consider in his sport. In flying he should make himself familiar with the gliding angle, period of flying, distance of flying, altitude of flying, direction of flight, wind conditions, weather conditions, condition of ground for landing, etc. There is danger of bending or breaking the wings of the lighter built gliders, especially when exposed to sudden heavy winds or movements. A damp atmosphere may affect the wood used in the construction of the glider unless it is well protected against the entrance of moisture. A hand-wheel may be used for operating the controls. The fuselages should not be too short, and a double skid beam is preferable to a single one so as to better protect the wing tips in landing. Roller balls for the chassis are of advantage except for landing on slopes, in which case a brake should be at command to prevent the glider from rolling downhill, and a brake is also desirable for chassis equipped with wheels. An excessive speed of the glider may prove dangerous unless the plane is built sufficiently strong to withstand the severest strains likely to be encountered. The flyer should have an open view to the front, sides and partly to the rear of the glider. Air-operated brakes might be desirable.

An ideal gliding and sail flying territory includes mountains of suitable height, favorable winds, smooth ground for landing and various desirable facilities for establishing a summer camp. Experts prefer a mountain territory rising quite vertically from the valley and which recedes uniformly towards the directions of suitable winds, without foot hills to alter the air currents. The probability of wind velocities of 20 to 39 ft. per second should be at least 50 per cent and certain directions of wind should predominate. The sub-soil should not be rocky but should have large spots covered with humous earth and grass sod to permit starting and landing; small patches of woods do as a rule not interfere. The territory should be easily accessible from traveling and tourist conveniences and should offer plenty of accommodations. It is advisable to build a fire or maintain some kind of flame perhaps 1640 ft. from the starting place to tell the

Glider enthusiasts will welcome the announcement that the next issue of Popular Aviation will contain the first of a series of articles on gliders by the noted German authority—Dr. Alfried Gymnich.

Table No. 1

Mountain	Height in Feet	Upper Limit of Air Current	Per Cent of Mountain Height
Feldberg	2,690	853	.32
Brocken	3,746	984	.26
Ritten	4,921	1,312	.28
Kalkalpen	8,202	2,133	.26
Diablerets	10,827	3,281	.30

Table No. 2

June 6, 1913, 12:24 P. M.		Nov. 16, 1913, P. M.	
Altitude ft.	Velocity ft. per sec.	Altitude ft.	Velocity ft. per sec.
0-794	0.59	0-249	0.00
794-1037	2.07	249-417	minus 1.38
1037-2290	4.43	417-1273	0.43
		1273-1995	5.5

Table No. 3

	May 15, 1916, 8-9:00 A. M. Clouds 10		
Ground	52.2 degree F.	S.W.	36 ft. per sec.
656 ft.	49.7	S.W.	85-95
1640	49.5	W.	72.82
3281	47.2	W	72

flyers by the smoke when sudden gusts of wind approach, thus aiding them to make a safe landing in quick time.

Flyers should guard against spilling over with the light glider when making the start. They are advised to fly with bare head, as that makes it possible to feel the wind better. Flying with the slow speed of 16 to 25 miles per hour, the landing speed of the gliders is very low. The flyers should make records of air velocity, and the weather conditions of the gliding field, besides of their experiences in flying. The instruments that are used today for surveying the air conditions of a glider and sail plane field include levels, balloons, theodolites, barographs, registering theodolites, meteorographs, flying recorders, chronometers, anemometers, temperature indicators, motion picture apparatus, etc. The ascending air currents may be classified as follows: mechanical, which is the ascending or slope wind forced up from such obstructions as mountain slopes, sea waves, etc., thermic, which occur above relatively warm places on the earth, and dynamic, which are the ascending friction currents arising at the junction of sea and land, field and forest, level country and mountains. These currents affect each other. The ascending current is observed frequently in a mountain slope which narrows towards the mountain range, or at the head of a valley, so that the winds converge there and ascend. The conditions of wind and weather are of course different for each field.

A satisfactory gliding and sail flying field may be exemplified by the dune territory of Rossitten in eastern Germany on the Baltic Sea, which has become famous all over the world for the gliding records made there by Schulz and others. Rossitten was originally selected as a camp for glider pilots because of its excellent geographical features. The sea dunes at Rossitten are a wave of sand which is broken only for short distances. It leads to Memel from the Kurische Nehrung. The height of the dunes above the sea does not exceed 33 ft. The average inclination of the dune slopes is 25 degrees. These dunes have sufficient ascending air currents to make gliding possible by skillfully piloting the glider. The air currents on the 98 ft. wide level dune shore have very favorable characteristics for gliding. On the average, the following air velocities prevail: Coast line, 25 ft. per sec.; centre of level coast, 24 ft. per sec.; at foot of dune, 23 ft. per sec.; one-half up the dune, 27 ft. per sec.; top of dune, 33 ft. per sec. The average altitudes flown are 98 to 131 ft. above the crest of the dunes and rather above the foot of the dunes where there are more ascending air currents. Nehring flew more than a mile over a level country which is interrupted only by trees and a few buildings at Cranz, at an altitude of 230 ft. in the ascending air current only, the vertical movement of the air being 2 to 2 1/3 ft. per sec. Flights are possible along all level coast lines as was proved at the contest held in 1927. At the Rossitten contest, there was also a hydro-glider which was started from the water by being towed with a motor boat. After the tow line was detached automatically, the hydro-glider flew about 60 seconds and then landed on water.

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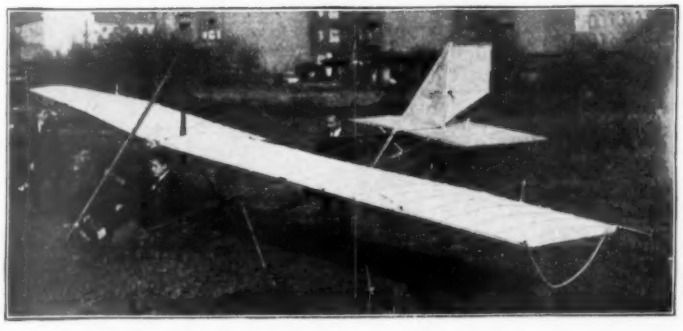

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A New Avigation Instrument

(*Continued from page 33*)

zon approximately 90 degrees either to the right or left of this point, only one of the latter points being used at any one time. The part of the horizon directly in front of the observer can be observed only by tilting the telescope until it makes an angle with the horizon equal to the angle set on the "latitude arc." If this angle is made equal to the latitude plus the dip of the horizon, then the collimation axis will make the same angle with a horizontal plane as does the earth's axis, the effect of the dip being allowed for in the right or left view mirrors by rotating them in the instrument's equatorial plane by an amount equal to the dip of the horizon times the secant of the angle set on the latitude circle. This is a small quantity and the dip screw may have a dial giving the settings directly for all ordinary latitudes.

"In practice," Kaster explains, "the latitude arc could be set and then the dip screw turned while observing the three horizon points until the right and left horizons intersect at the center of the field. The correct dip is then set on the mirrors without knowing its value beforehand. If the declination circle is now set to the known value of the apparent declination of some object and the instrument turned about a vertical axis the line of sight will sweep out a small with the zenith as a center. The object can then only be seen when the hour angle is set to a certain value. If the true latitude plus dip has been set on the latitude arc then this hour angle reading is the real apparent hour angle. If some other latitude has been used, then the hour angle observed is that which the body has at that latitude on the Sumner circle of position, since the altitude and declination are correct, leaving only the latitude as variable in the zenith-pole-star triangle."

Kaster has worked out the details of determining the various index corrections, eccentricities, etc. Their theory is a combination of the theory of the sextant and the equatorial, with special methods for determining the constants due to the construction of the instrument and the availability of a sea horizon when in use. In a model used for practice, total reflecting prisms could replace all except two of the mirrors in his first model.

In actual practice the navigator would set off the dead reckoning latitude to the nearest degree on the latitude arc, the declination corrected for refraction on the declination circle (by use of a short table of refractions in declinations used by surveyors) and adjust the dip screw to the proper dip for the left and right mirrors. Then, on bringing the instrument into position, he would get the two portions of the horizon to intersect at the center of the field as marked by cross wires. These horizons will intersect each other at an angle equal to the latitude. Then on

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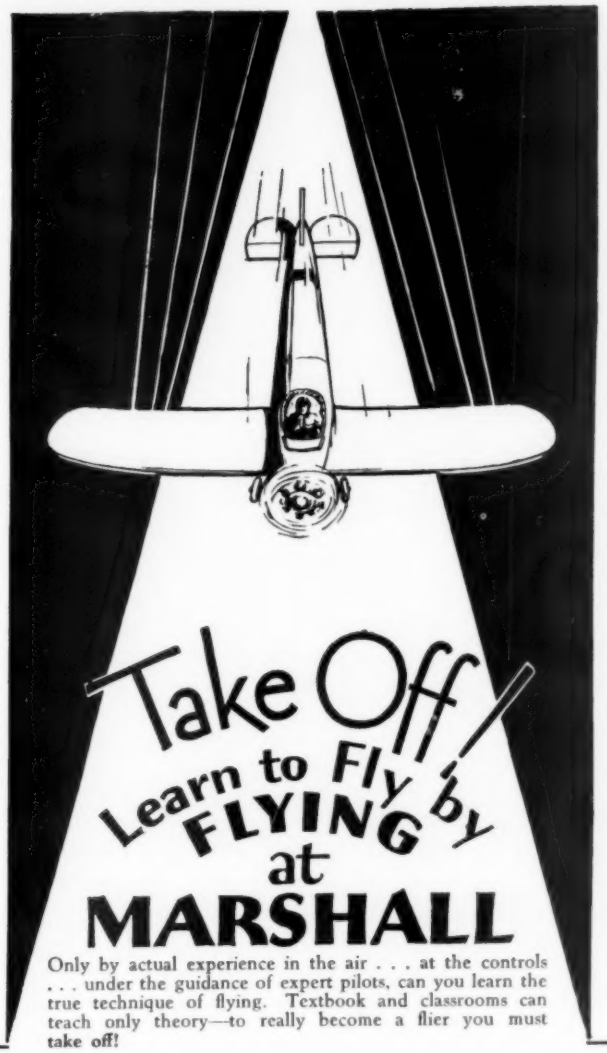
turning to right and left the hour angle will be shifted until the sun or other body is centered in a square reticle or, better, made tangent to the two horizons, taking the mean of two positions. The chronometer and hour circle are then read.

Should another reading be taken with the latitude arc reading changed by one degree, another hour angle will be read giving two points, which, when changed to longitude in the usual way, give two points on the line of position, when the reading may then be plotted directly on the chart. If either the latitude or hour angle are known, an observation may be made for determining the other directly from the instrument, as in the case of the a. m. and p. m. sights and circummeridian latitude sights.

On the model, duplicates of which have been constructed for experiments by the army and navy, by covering the astronomical view prism and the left and right prisms the remainder of the system can be used exactly as a sextant up to a maximum angle of 90 degrees. By clamping the hour angle at zero and covering all the horizon prisms or mirrors, any angle up to 360 degrees may be measured on the declination circle. Under ordinary conditions the instrument needs no special base, but in rough weather (or air) a gyroscopic pendulum could be used to steady it, yet leaving it free to be oriented by two points on the horizon.

Oakland, Calif.

The Citizens Aviation Association of U. S. A. recently organized a division of the association in the East Bay district. This territory includes Oakland, Alameda, Berkeley, Richmond, San Leandro and Hayward. The offices are in the Federal Building of Oakland, where interesting aeronautical exhibits are on display. The meetings are held weekly at the Hotel Leamington when prominent aviation authorities discuss topics of interest regarding aviation. A set of By-Laws and Code of Ethics have been adopted, and every member is called an "Aerotor." All citizens are eligible to membership.



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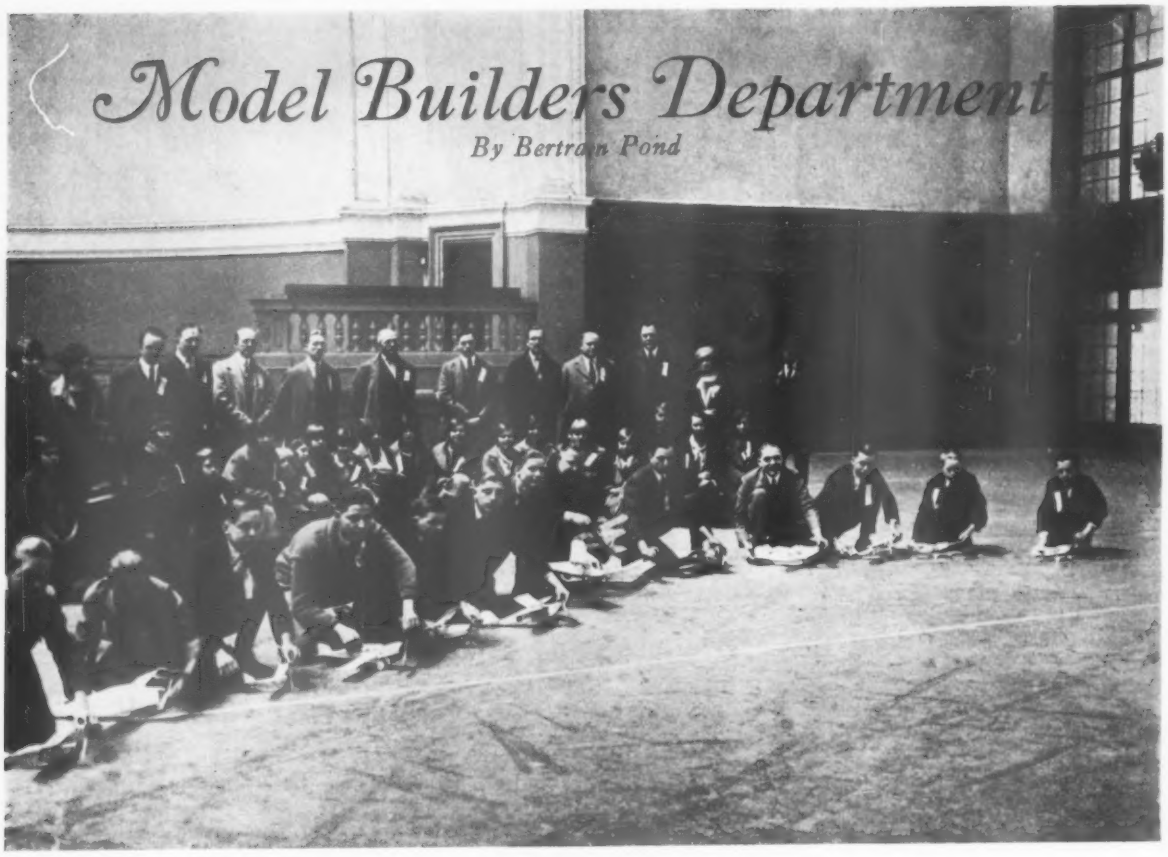


Model Builders Department

By Bertram Pond

A few don'ts and hints for model builders that will help them to overcome some of the commoner faults that keep builders from making record flights.

A GOODLY part of airplane design is in refinements and details. It is the details that really make the model. A very poorly proportioned model if made light and with the better refinements will out perform a correctly proportioned model which has not had sufficient attention paid to the design of the details. These little details and kinks, however, are generally found on the correctly proportioned models, as they are the results of experience and practice with models, as well as the results of knowledge gained from the experience of others, as shown on these model pages. We are giving a general discussion of details of indoor models this month, which includes some of the ideas used on the champion models in recent indoor contests all over the country.

Correct Shaft Lengths

The first sketch shows two very good points in making the propeller shaft and bearing, and the front of the motor base. You will notice that the bearing is cut very short, and fits on the end of the motor base. In this manner considerable weight of steel can be limited. The little cutout in the motor base permits ample clearance for the propeller shaft, and at the same time it allows the rubber to lie closer to the motor base. With the rubber close to the motor base, there is less bending strain on it, and consequently the motor base can be made slightly lighter. In this connection, there is a point that many model builders fail to get about the propeller shafts. Most model builders either get these too long or else too short. If the propeller shaft is too long, the weight of the steel is unnecessary and excessive and the rubber motors are not as long as they could be. Then, on the other hand, too short a shaft has the following disadvantages:

If the rubber is off center in the hook, the propeller revolves out of balance, sometimes because of the rubber knotting up on the hook, even though the rubber is in the center of the hook. Now then, the question is just how long or how short should the shafts be? The best way is to give the average used by the experienced flyers, which runs from one-half inch to one inch for small propellers, up to six or eight inches in diameter, and from one inch to one and one-half inches for propellers from eight to twelve or thirten inches in diameter. Longer or shorter shafts than these will get you into trouble one way or another. It is understood that these shaft lengths are intended for use with the single point contact thrust bearings.

Flexible Wing Beams

A refinement which all expert indoor model builders have to con-

sider is the flexure of the wing beams. If the wing beams are so stiff that they are not noticeably bent, they are somewhat heavy. If the wing beams bend too much, the model will fly erratically and often do a tight spiral to the ground under the extra load imposed upon them by the fully bound rubber motors. The best way to arrive at the correct size of the wing beams for your indoor model is to build a wing with light beams and one with heavy beams and try them out on the same motor base you expect to use in a contest; and, of course, choose which one will stand up and perform best for you, or if necessary, make a wing with medium beams.

If one beam should bend more than another, you will often get into trouble, though certain beams may help you a bit.

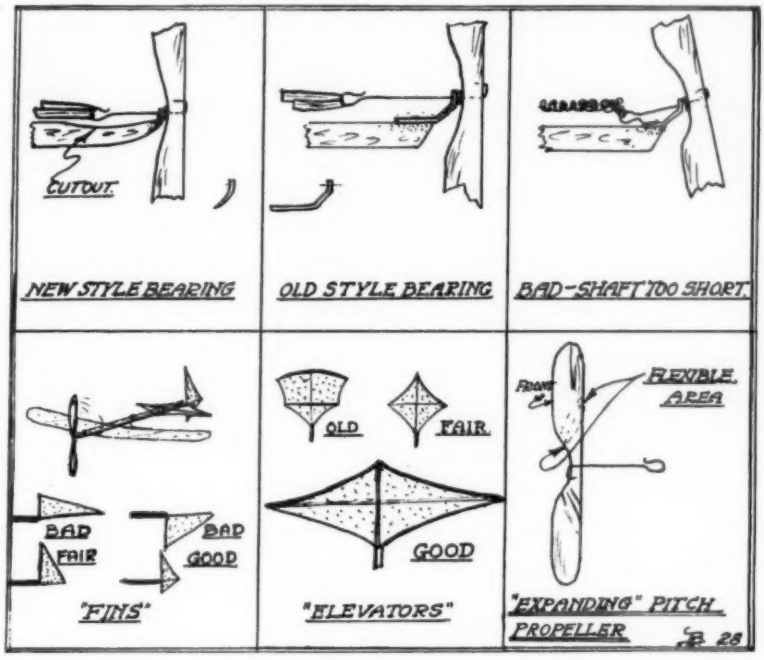
A bad condition is to have a front beam, on the inside of the circle your model flies in, too flexible. A good condition is to have the outside front beam slightly flexible for indoor tractors, as this will give the fully wound model a quick climb when properly adjusted otherwise. Experimenting with the flexure of the beams in your wing will give you some of the finer points of indoor model work.

Flying in Circles and Figure Eights

This is a very common trouble with indoor models, especially where the size of the room is limited, to have the model fly well in circles and towards the end of its flight turn in the other direction, flying in a figure eight. This would be all right if there was ample space, but it can be taken care of very nicely by making the motor base the proper width, so that the varying twist of the motor base will counteract the varying torque of the propeller by twisting the wing. That is to say the twist of the motor base between the wing clips can be made so that the wing will be twisted just the proper amount to counteract the torque of the propeller at any stage of the flight, making your model circle continuously, rather than do the objectionable figure eight.

Making Fins and Elevators

A large amount of undisturbed air passing over a fin or elevator gives us the most stability. Therefore you can see that a long fin or rudder is not as good as a high fin or rudder. The same holds true in elevators—a wide elevator being better than a long elevator. A high aspect ratio is more effective for a given area. There is a limit to all good things, of course, and a good proportion for indoor elevators is shown on the drawing. Do not put all of your faith in a fin above or below the motor base. The fin below the motor base has the tendency of holding a model in an upside down position or even helping it to get in such an awkward and hopeless position. The fin with most of its area above the motor base and about half that much or one-third of the total fin area below the motor base would make a very good design from the point of aspect ratio, but some of the model builders find these fins somewhat difficult to construct. In making the edges of your fins and elevators, it is not necessary to put any thread or binding of any kind around them, providing you have a good grade of smooth Japanese tissue paper, and cut the edges smoothly with just a slight scallop or curve. If you must put a thread of some kind around, take a silk thread and untwist it, and use one of the split strands as a binding. You may find that it will be necessary to banana-oil this split strand to hold it together while you handle it. One split thread is more than enough for the purpose.



Expanding Pitch Propellers

Another very interesting feature to play with is that of flexible propellers. At the beginning of the flight when the motor has the most power it is suggested that the propellers be constructed to flex to a slightly higher angle under the heavier pull of the rubber, and as the pull decreases, the strain on the blades of the propeller will decrease and they will gradually flex back to the former pitch as the rubber tension decreases. These propellers have been tried on many models, and the results have always been very interesting. It is a good field for further thought and development. I would like to hear of some recent experiments along this line. Old experiments in this country have shown the need of further development of expanding pitch propellers.

Forming a Model Club

If you have not already formed a club, you should do so at once, for much profitable experience can be gained by the mutual contact of the members. New clubs which have the proper leadership are making their

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mark and forging to commanding positions in National Model circles.

A few suggestions are always helpful to those who have never had experience in starting or belonging to a model club. Here are some which might be of interest and perhaps start you off "on the right track."

It is an easy matter to get ten or twenty boys together for the initial meeting. Before starting elections or business discussions, be sure that each one is interested in models and intends to build them. After this has been decided, elect the President and commanding officers. Some local aviator, Scout Master, or teacher should be chosen as an advisor to attend the meetings and offer advice to the members.

A fee for joining the club (50 or 75 cents) and a small weekly fee (5 or 10 cents) should be set and strictly adhered to. This money can be used for printing meeting postal cards, to buy materials (which afterwards can be sold to the members), and perhaps a stop watch to time contests accurately. Some good publications on building a flying model airplane should be purchased, and last but not least, a year's subscription to *Popular Aviation*, to be used as a handbook for the members.

An important thing to do is to map out a program for each meeting. This is a suggested one and we think worth while. Call the meeting at a certain hour each week. When the members have assembled have roll call and check the ones not attending, for purposes of getting in touch with them and finding out why they were not there. After the dues have been collected, the models which the members have built should be flown. After each person has flown his model three times, the instructor or advisor is given a chance to explain why some of the models flew farther or had a greater duration time. This informal talk can be given in the "camp fire method"; that is, all gather around him in a semi-circle while he demonstrates the good points in one plane and the poor in another.

When his talk has been finished the President should announce the next models to build, usually giving a choice of one out of two which have been selected. The members

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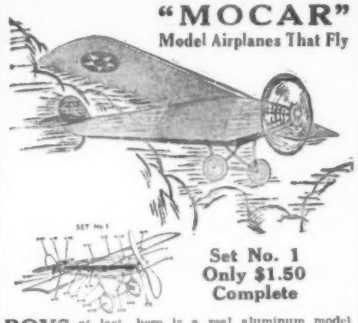

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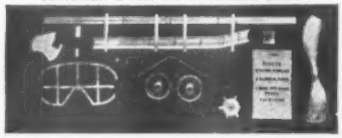

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are told where the plans can be secured and what materials to use.

The "actual flying" of the meeting ends there, unless some one wishes to demonstrate the model he has built. When all the flying is ended, then is the time to come "down to brass tacks" and talk business. Plans can be discussed for interviewing different newspapers and securing a "write up" of the club in general, contests can be given where some prize should be donated by a prominent club, or the Association of Commerce, and trips can be taken to distant meets. All these contests will eventually bring attention to the club, which means a greater membership, more models built, and a greater surplus in the treasury with which to accomplish plans that are always discussed whenever a live club meets.

Model builders, take notice that the California Air Race Association have announced that two special events, open to boys and girls of 18 years or under, will be held during the National Air Races, in Los Angeles, September 8th to 16th. Prizes amounting to $1,500, as well as valuable trophies, will be given to the winners. Further details can be had by applying to California Air Race Association, Los Angeles.

If these suggestions are followed and good leadership obtained, there is no reason in the world why a Model Airplane Club should not be a "whooping success." It does require some careful planning and hard work, but the future gains are well worth the trouble. If ever you have any difficulty in forming or keeping organized a club which you know could be progressive, write to the Model Club Editor, *Popular Aviation*, and he will be glad to offer any advice which would be of help. The model builders are the future aircraft builders and every opportunity should be taken to give them a "shove down the path of success."

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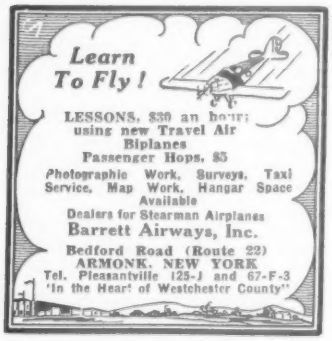
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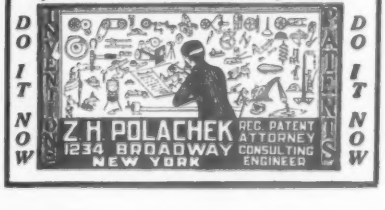


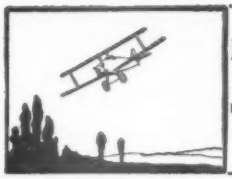
Stepping Out

(*Continued from page 26*)

lease cord to seize and open the chute.

Major Dargue's membership in the Caterpillar Club dates from the time of the arrival of the Pan-American Flyers at Buenos Aires, Argentina, in the course of their flight around South America. His jump and that of his relief pilot, Lieut. Ennis Whitehead, were rendered necessary by reason of a collision in the air just as the Army flyers were preparing to land. Major Dargue had been watching a formation of Argentine planes, also the Amphibian "Detroit," piloted by Captain Woolsey, which was then approximately half a mile away to the rear and to his left. He expected to see Captain Woolsey emerge on the right side ahead of him, but after watching for some appreciable time assumed that he must have changed his course and raised his head to look over the left side of the plane. Just as he did so he caught a flash of yellow and black, followed immediately by the crash. Both planes folded up on each other and started rapidly for the ground in a violent spin.

There was considerable confusion due to the unexpectedness of the crash and to the many objects flying out of the planes which passed over the airmen's heads. Major Dargue, however, immediately found his safety belt, released himself, and was reaching for the sides of the cockpit to make



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the jump when he was literally thrown out of the plane.

"My parachute ring must have caught on something," he stated, "for I have no recollection of pulling it, and yet my parachute opened just as I was leaving the plane and caught on the wreckage. At the same time I received a violent thud in the left side from striking some part of the plane.

"I was carried rapidly toward the ground along with the wreckage and recall distinctly thinking this was the end. It seemed impossible to escape, but all of a sudden a giant hand held me aloft and looked above to see a rip in my parachute from skirt to crown and two large holes, the size of the top of an office desk. Several shroud lines were cut and dangled all around. Pieces of plane filled the air and I caught a glimpse of another parachute far above me.

"A double crash and one plane burst into flames, and then I struck the ground rather violently. I could not have been very high when my parachute broke away from the wreckage and saved my life, for it seemed only a couple of moments between the opening of the chute and my safe landing."

Major Dargue is one of the pioneer aviators of the Army Air Corps, having flown since 1913 when the Army had a mere handful of planes. It is safe to say that his initiation into the Caterpillar Club was the outstanding event in his long flying career.

Women and Flying

(*Continued from page* 46)

beauty in the sky; there is loveliness such as you have never dreamed of; and there are spaces and peace. The sky is ever changing, there is infinite variety; yet always there is that feeling of boundless space; and space means freedom; and freedom means peace.

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Testing Engines

(*Continued from page 28*)

ternal pressure of one ton per square foot. This room contains refrigerating coils, a stand for mounting the engine, special connections for supplying measured quantities of air, fuel, oil and water to the engine, for taking away the exhaust gases and for measuring the temperatures and pressures in and about the engine. The engine under test is connected by means of a shaft extended through the wall to an electric dynamometer for controlling the load and measuring the power developed. All the scientific measurements are made by means of instruments outside the test chamber. With this equipment the pressure at the intake and exhaust, as well as the temperature, pressure and humidity of the air entering the carburetor and surrounding the engine, are controlled. The engine can thus be run on the ground under the precise conditions which would be met with at altitudes ranging from one to five miles or more above the earth's surface. Before this altitude chamber was perfected, crude tests of airplane engines and superchargers were made on top of Pike's Peak.

During the last decade all the important American-made water cooled engines and several foreign makes have been subjected to comprehensive tests in the Washington altitude laboratory. In many cases important defects have been discovered and remedied because of the ability to make very accurate measurements under the extreme conditions of pressure and temperature encountered in flight.

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Britain in the Air

(*Continued from page 22*)

worth Argosies are built by the Armstrong-Whitworth Works in Coventry at a cost of £22,500 each, or $112,500. Each is powered with three Armstrong-Siddeley "Jaguar" air-cooled motors which give the planes each a total of 1,200 H.P. and a top speed of 110 M.P.H. Their specifications are as follows:

Wing span	90 ft.
Length	64 ft. 6 in.
Height	19 ft.
Wing area	1,890 sq. ft.
Weight fully loaded	18,000 lb.
Wing loading	95 lb. sq. ft.
Power loading	15 lb. per H.P.
Flight endurance	3½ hrs. at 95 M.P.H.
Paying load	4,500 lb.
Top speed	110 M.P.H.

The Imperial Airways uses two types of DeHaviland planes, the small planes for charter or special flights and the large tri-motor De Haviland 66 or "Hercules" planes. The small De Havilands are the well known D.H. 50's and are built with cabins large enough for four passengers being equipped with a single motor up to 450 H.P. The "Hercules" is a large biplane built to carry fourteen passengers as well as considerable freight and baggage and are used on the lines in the Middle East. Their accommodations are similar to those of the Handley-Page planes though in size they are somewhat smaller. At present the Imperial Airways is operating five of them, the City of Delhi, City of Cairo, City of Bagdad, City of Jersualem and City of Teheran. All of them were flown out to the Middle East in 1927 to be put into the service that leads over the Pyramids, the desert lands and the oldest civilizations in the world. They are equipped with three Armstrong-Siddeley "Puma" motors which give a total of 1,275 H.P. each. Their specifications are as follows:

Wing span	76 ft. 6 in.
Length	56 ft.
Height	18 ft. 3 in.
Wing area	1,547 sq. ft.
Weight of pay load and crew	2,900 lb.
Weight fully loaded	15,100 lb.
Speed, maximum	130 M.P.H.
Speed, crusing	110 M.P.H.
Absolute ceiling	13,000 ft.
Flight endurance	5 hrs.

These tri-motor "Hercules" planes are able to carry a full load with any of the two motors running at a speed of 95 M.P.H. and with one motor going can descend to a field thirty miles distant from an altitude of 4,000 feet. The plane can likewise descend with one motor going at a speed of from 80 to 90 M.P.H. Owing to the climatic conditions in which these planes fly several variations in their construction were necessary. The engines, for example, develop greater horse power than planes of equal size used in cooler climates while the rudder is in three sections so as to bring about quicker response to the controls in the warm climates of the Middle East.

For the Channel service between Southampton and the Island of Guernsey, a distance of 120 miles, requiring an hour and a quarter, Supermarine flying boats are used. These are now all-metal planes, since this construction has many advantages over the flying boat

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with the wooden hull. A notable advantage is found in the fact that the metal hull cannot become water logged. During last year tests were made on a flying boat with a wooden hull and it was found that at the end of a summer's usage the hull had soaked up several hundred pounds of water, and as a consequence its efficiency was greatly reduced.

Practically all of the planes used by British commercial lines were at the outset equipped with water-cooled motors, but since then the air-cooled motor has been so perfected that this type is gradually replacing the heavier water-cooled motors when such changes are feasible. On all Handley Page W-8's and W-10's water-cooled motors are used, usually two Rolls Royce or two Napier motors. The Napier "Lion" 450 H.P. motor is at present used more than any other type of motor on these planes and has many times proven its worth. A feature of this motor is the fact that while it weighs 945 pounds, it weighs but 2.07 pounds per horsepower, which is very light for a watercooled motor. By using extra long exhaust pipes with numerous perforations on the Handley Page planes much of the noise of the motors has been reduced without the use of a muffler. The principal air-cooled motors used on the equipment of the Imperial Airways are the Bristol-Jupiters and the Armstrong-Siddeleys. Air-cooled motors are used principally on Armstrong-Whitworths, De Haviland "Hercules" and on one of the W-9 tri-motor Handley Page planes. Inertia starters are now being used on most of the planes to start the motors with. It has always been the policy to have plenty of reserve horsepower on all of the Imperial planes and the loading of the planes are always carefully weighed and checked before the departure.

As is the case with practically all commercial planes in Europe, the planes of the Imperial Airways are equipped with radio and are able to both receive and send messages. The aerial is generally suspended from beneath the plane's nose while in flight and the source of current is derived from a small wind driven generator. The ear phones and mouthpiece are built into the pilot's helmet. Messages are given and taken by word of mouth and the large initials which appear on the wings and fuselages of these planes are their identification and call letters. With the assistance of the radio the pilot can always be certain of his whereabouts and it has often been able to render great assistance when heavy fogs are encountered over the Channel or in the London area. A new gyro-controlled rudder, a recent invention, has been installed on several of the planes by way of testing them and if these tests prove satisfactory it is likely that it will become a standard equipment on all of these planes.

As the result of a price war with the French Air Union towards the close of last year a new innovation has come to be introduced on the London-Paris line, that of first and second class air service. The principal difference between these services is in the price, the first class now costing 700 francs, or 5 pounds, 15 shillings and 6 pence, which is equal to 28 dollars, while the second class fare for the one way trip amounts to 590 francs, or 4 pounds and 15 shillings, equal in our money to 23 dollars. The first class service is now known as the

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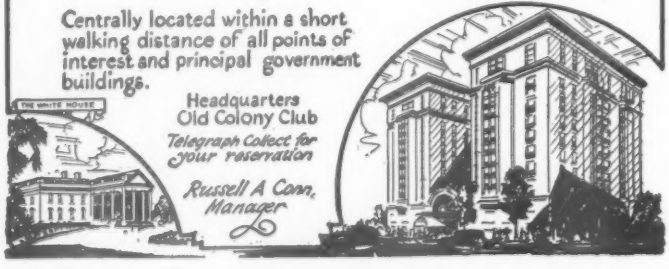

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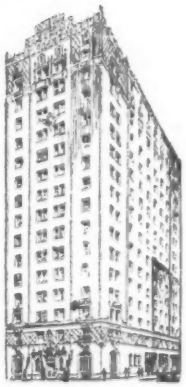

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De Luxe Silverwing Service and makes use of Armstrong-Whitworth Argosy planes. While the hours of departure for the second class service are not so convenient, the early riser who would fly across the Channel will receive compensation for his patronage by way of being served his breakfast while en route. It has been the writer's observation, however, that often these air travelers prefer to make up for lost sleep instead, for flying is strangely inducive to sleep.

An asset that has greatly aided Britain in building up their commercial air services is the fact that Britishers are an air minded people and use their air services. Likewise the British are great travelers and probably travel to greater distances than do most Europeans when abroad so that with an efficient air fleet at their disposal to carry them to the limits of their Empire, it is only natural for them to use the commercial plane as a means of quick transit. It is true that a considerable percentage of the Channel traffic is American during the summer, but it is British patronage that contributes to its support throughout the year. A large percentage of the passengers who use these air services are business men who find the plane a great time saver. By using the boat and train, the fastest passage between London and Paris is seven hours, while the plane can cover the 225 miles in a little more than two hours. The British plans for their future air development are ambitious but practical, and their progress will be watched with interest, particularly their activities with dirigibles. Though the British Government supports a large military and naval air force their commercial air fleet is at the same time comparable to the best in Europe.

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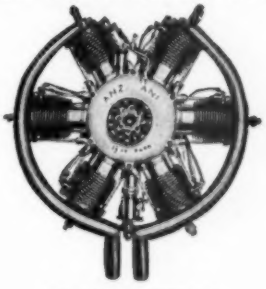

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Eagle Spreads Its Wings

(*Continued from page* 15)

climbing in an attempt to get over the clouds before jumping. The main tank went dry at 7:51, and the reserve at 8:10. The altimeter then registered approximately 14,000 feet, yet the top of the clouds was apparently several thousand feet higher. I rolled the stabilizers back, cut the switches, pulled the ship up into a stall, and was about to go over the right side of the cockpit when the right wing began to drop. In this position the plane would gather speed and spiral to the right, possibly striking my parachute after its first turn.

"I returned to the controls and after righting the plane dove over the left side of the cockpit while the airspeed registered about seventy miles per hour and the altimeter 13,000 feet. The first indication that I was near the ground was a gradual darkening of the space below. The snow had turned to rain and, although my chute was thoroughly soaked, its oscillation had greatly decreased. I directed the beam from the 500-foot spotlight downward, but the ground appeared so suddenly that I landed directly on top of a barbed wire fence without seeing it."

In subsequent portions of his report Colonel Lindbergh told of finding the plane next morning, of finding the mail undamaged, and of delivering the pouches to Maywood, Illinois, where they were dispatched on later planes.

The world has seen in Lindbergh the inspiration of devotion to service and desire to help aviation. It exists also in many others less renowned. It is, first of all, due to men like these that the last decade has seen such a remarkable growth in mail aviation—a growth that is astounding from the humble start of 218 miles in 1918 to the 10,058 miles flown today.

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College Aero Clubs

(*Continued from page* 68)

scholastic standing is at least average, are asked to join the fraternity.

The growth of Tau Omega is assured since the Engineering School will offer courses in Aeronautics, beginning with the Fall term of 1928 and thus the University will be taking up work closely related to the interest of this group. Three years of regular Engineering will be prerequisite to one year of specialized Aeronautical Engineering work. Designing, construction, and theory will be included in the roster. However, no flying will be done in connection with the course, but it is probable that the majority of the students will be flying under Mr. Hazlipp who is now teaching the group in the fraternity.

The officers of the group are James G. Hazlipp, Norman, Okla., President; Warren Daniels, Norman, Okla., Vice-President; C. C. Caldwell, Dunlap, Iowa, Secretary-Treasurer; Orville B. Gulker, Kingfisher, Okla., head of Public Relations. Other charter members are Earl Weining, Bartelsville, Okla.; Court Hays, MacLoud, Okla.; and Prof. Williard Darrow of the Fine Arts School.

Carnegie Institute

As a result of petitions from undergraduates and requests from prospective students outside of the institution, a new course in aeronautical engineering will be given at the Carnegie Institute of Technology beginning in the fall of 1928, it is announced. The course is to be offered as an "option" in the Department of Mechanical Engineering of the College of Engineering.

That the new course will be one of the most popular on the campus is indicated in the report that more than half of the fifty sophomore students in mechanical engineering next year have already elected to specialize in aeronautical engineering.

"The instruction in the new course," William E. Mott, director of the College of Engineering announced, "will be of undergraduate

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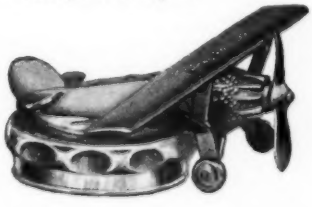

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character, and is intended to give aeronautical students the same amount of technical instruction as that received by students in other undergraduate courses such as mechancial, electrical, and civil engineering. It also will enable students graduating from the course to enroll in the post-graduate courses which are offered in a few institutions in the country, and which are endowed by the Guggenheim Fund."

The course will offer instruction in elementary aeronautics, theory of fluid flow, theory of airplanes and propellers, theory and design of dirigibles and airplanes. A wind tunnel for measuring the forces exerted by air upon airplane and dirigible models will be installed. Likewise, it is expected that airplane engines of different makes and airplane engine instruments will be available for study and test purposes by the students.

"It is somewhat difficult to foretell at the present time just what the students will do after they finish the course," Director Mott observed, "but aviation is developing so rapidly that they will doubtless be absorbed by the aeronautical industries just as quickly as engineering students along other lines of work are absorbed by the various industries."

Professor A. H. Blaisdell, who was active in the airplane and airplane engine maintenance school at Carnegie Tech during the War and who has made a study of dynamics and of fluid flow, will spend all of the coming summer at a number of air fields and airplane factories for the purpose of familiarizing himself with the latest developments, it is announced. He will also examine the equipment now in use at the various schools teaching aeronautical engineering.

Professor Willibald Trinks, head of the Department of Mechanical Engineering, who is leaving for Europe in June, plans to visit the famous wind tunnel in Goettingen, Germany, to study the latest and best measuring instruments in connection with wind tunnel work.

Carnegie Institute of Technology also has a very successful Aero Club of which something will be written next month as well as others from whom we have not received the latest information.

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Yale Aeronautical Society

The Yale Aeronautical Society was formed January 28, 1927 by Henderson Emanual who was the first president. Since that time it has come to assume its place as one of the foremost college organizations.

The Society was fully recognized by the faculty of the University who have been cooperating with it in every possible way. Its purpose was the promotion of Aeronautics at Yale University and the study of this field from all angles. It has been authorized to give instruction in practical and theoretical aviation to University students and is directly responsible to the President. No racing or competition is allowed in actual flying.

The society, itself, gives instruction in aircraft, aircraft motors, flying, airports and airways, and commercial aviation for its own members but no University credit is allowed. Research is promoted to a very great degree in all branches of aeronautics.

Actual flying instruction is given at the Hartford Airport under Lieut. H. D. Copeland of the Connecticut National Guard to those students who are in good standing, at special rates. Two Travel Air ships are now being used but two private

planes are owned by members; one being a Waco 0X5 and the other a H. S. MF Boat. No regular Seaplane instruction is given, however. Parents' permission must be obtained in order to be eligible for the training.

The Society certainly can have reason to feel proud of its achievements and the tremendous amount of work that has been accomplished in slightly more than one year. It has four licensed pilots and two mechanics. From the period beginning January, 1927, to May, 1928, the members have received a total of 480 hours in the air while one has more than 200 hours—almost as much time as the cadets at Brooks Field receive. Twenty-five are taking instruction at the present time.

Besides their own courses and the flying instruction given they have accomplished many other worth while tasks. They made an airport survey for the city of New Haven and influenced the city to take options on a 240 acre site. The construction, which is awaiting legislative action, will be begun early in 1929. They have succeeded in awakening the air-mindedness of not only the University but the whole city of New Haven. They established aviation as one of the recognized activities and succeeded in preventing the ban on flying by the University which was, already, to take effect.

Just recently two very interesting meetings were held as special features. On Friday, February 24, Count Igor Sikorsky, the president of the Sikorsky Manufacturing Company, the builder of amphibian airplanes, and the designer of multi-motored ships, gave a most interesting talk on "New Developments in Aviation." Count Sikorsky mentioned some of the most recent developments in the industry and made many interesting predictions as to the speed of the future, saying that he thought that, in 15 or 20 years, speeds of 1,000 miles per hour or more would be attained.

Professor Alexander Klemin, Dean of the Guggenheim School of Aeronautics of New York University, gave an illustrated lecture on wind tunnel tests on airfoil and crash tests made at McCook Field, on Tuesday evening, March 13. The pictures that he showed were at the rate of 20,000 per second but were slowed down to the usual rate of 16 per second when presented. The pictures gave a vivid exhibition of the actual conditions under which projectiles and other rapidly moving objects make their flight through the air. Professor Klemin has invited the Society to make the trip through the Guggenheim School, in body, during which time the use of the wind tunnel will be demonstrated.

The officers of the Society are N. L. Engelhardt, 119 College Street, President; Ward H. Bolter, 360 Temple Street, Vice-President and Treasurer; G. E. Beardsley, Jr., 119 College Street, Secretary; S. B. R. Taylor, 148 Grove Street, Flight Manager; T. P. Ellsworth, 361 Temple Street, Bulletin Editor; R. B. Phillips, Jr., 1 Hollhouse Avenue, Publicity Manager.

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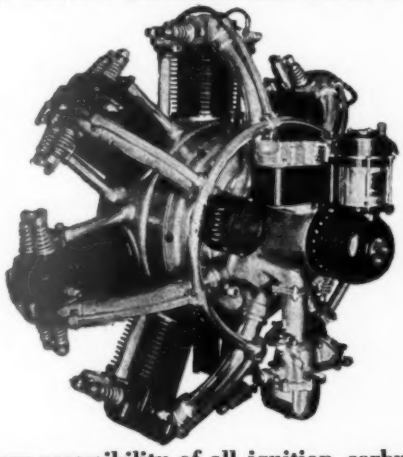

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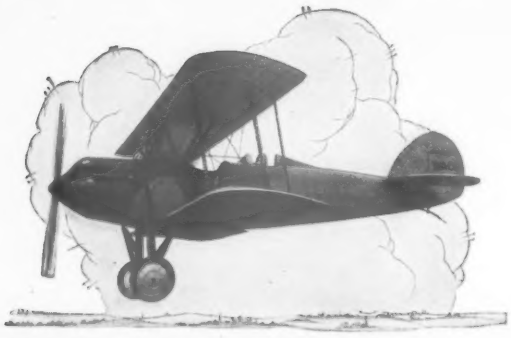

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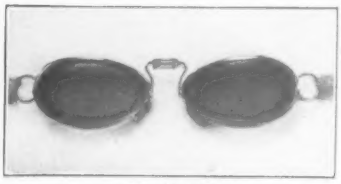

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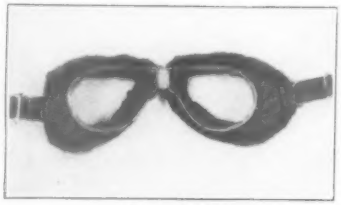

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